Seek the wisdom of the ages,
but look at the world through the eyes of a child.

Ron Wild

University of Alberta

Cultural Meaning of Climate and Weather: Agricultural Drought in East-Central Alberta

by

Michelle Ann Borowitz ©

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ABSTRACT

Researchers focusing on climate change and the Canadian agro-ecosystem have documented the economic, political, and technological possibilities of farm-level adaptive behaviour to agricultural drought. Their research takes a perspective that views agricultural drought as a biophysical constraint on human adaptability. What remains is a consideration of human relationships and cultural practices that give climate and weather its meaning. In this thesis, I consider farmers' cultural meaning of climate and weather that potentially mediates their adaptability to agricultural drought in the east-central Alberta prairie community of Bodo. Employing ethnographic methods, I document farmers' cultural experiences with agricultural drought, and their perceptions of interannual climate variability. Using historical ecology, an anthropological approach, I argue that weather and climate is not just an operational reference to meteorological variables, it is also a real context for human relationships and cultural practices that give climate and weather its meaning through time and space.

DEDICATION

For

Charlie (64-years old) –

thank you for your wisdom;

Cody (6-years old), Jessica (4-years old), and Sara (4-years old) –

thank you for showing me your world.

ACKNOWLEDGEMENTS

I direct my first acknowledgement to each research participant for their generosity and their hospitality. You expressed enthusiasm in my academic research, showed me patience with my never-ending questions, and accepted me as a member of your community. Thank you for sharing your memories, experiences, and stories with me.

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CHAPTER 1

INTRODUCTION

You can know the name of a bird in all the languages of the world, but when you're finished, you'll know absolutely nothing whatever about the bird... So let's look at the bird and see what it's doing – that's what counts. I learned very early the difference between knowing the name of something and knowing something.

Richard P. Feynman (1918 - 1988)

Don't knock the weather. If it didn't change once in a while, nine out of ten people couldn't start a conversation.

Frank McKinney 'Kin' Hubbard (1868 - 1930)

Statement of Purpose

The purpose of this thesis is to identify farmers' and ranchers'[1] cultural meaning of climate and weather that potentially mediate their adaptability to agricultural drought in east-central Alberta. In this thesis, adaptability is a cultural phenomenon referring to internally generated on-farm decision-making that allows farmers to respond to external forces, such as environmental stress. Researchers focusing on climate change and the Canadian agro-ecosystem have documented, described, and analyzed the economic, political, and technological possibilities of farm-level adaptive behaviour to agricultural drought. Their research takes a perspective that views agricultural drought as a biophysical constraint on human adaptability. What remains is a consideration of human relationships and cultural practices that give climate and weather its meaning. Employing ethnographic methods, I document farmers' and ranchers' agricultural and cultural experiences with drought, and their perceptions of interannual climate variability in the community of Bodo, Alberta, Canada. Historical ecology, a landscape-based approach, provides a theoretical and conceptual framework that considers climate and weather as a culturally constructed place, which conveys the human-environmental interaction in this particular prairie agricultural community.

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[1] For the purpose of this thesis, I interchange farmer(s) and rancher(s).

Thesis Objectives and Questions

The first objective of this thesis is to present ethnographic narratives of research participants that illustrate their experience with agricultural drought and their perception of interannual climate variability. For the second objective, I follow the landscape-based approach of historical ecology to analyze these narratives. In my qualitative analysis of these ethnographic narratives, I reference the following questions:

(1) Is local knowledge an influence on farmers' and ranchers' experience with agricultural drought and perception of interannual climate variability?

(2) What does agricultural drought mean to farmers and ranchers?

(3) What social context is a factor in farmers' and ranchers' experience with agricultural drought and perception of interannual climate variability?

In my discussion, I lay out my insights gained through this analysis and consider how local knowledge and generational experience inform research participants' cultural meaning of climate and weather.

Clarification

Before I continue, I will clarify a few points. First, while I acknowledge that the optimal approach to the research of human-environmental interactions is interdisciplinary, I have chosen to emphasize cultural processes in this thesis research, and largely exclude the influence of biophysical processes. This emphasis should not be taken as an *a priori* judgement of the relative importance of the biophysical *vis-à-vis* the cultural factors, but only as a means of keeping data collection and analysis focused on this thesis research.

My second clarification addresses definitions of climate change, interannual climate variability, and environmental stress, which generally fall into three broad temporal categories. Climate change is a reflection of long-term trends in, or scenarios pertaining to, mean temperatures and related climate norms. Interannual climate variability is a change in climatic conditions experienced through changes induced by interannual climate oscillations, such as El Niño-Southern Oscillation (ENSO). Environmental stress (floods, droughts, storms) may be a consequence of interannual climate variability, which in turn is an inherent feature of climate, and may be modulated by changing climate. In reality, these types of climatic stimuli are not separate or independent.

Selection of the Research Area

The east-central Alberta research area was selected because agricultural drought is not novel for the local farmers and ranchers, who have maintained long-term local knowledge and generational experience (see Chapter 5). For practical reasons the research area was selected because researchers with the *Bodo Archaeological Field School* are active in the area. Administered by the University of Alberta's Department of Anthropology, this project supports research for graduate students as well as an archaeology field school for undergraduate students. The presence of this project (since 2002) had obvious advantages in that it provided facilities such as campgrounds for accommodations and a local community building for office space. Furthermore, well known among community members, the field school allowed me to introduce my research and myself with comparative ease. Additionally, living in the community allowed for everyday contact with its members. Creating a relationship of mutual trust and confidence between potential participant researchers and me was important for my ethnographic fieldwork.

Location of Research Area

My research area is the agricultural community around the hamlet of Bodo, and within the Municipal District of Provost No. 52, in the province of Alberta, Canada (Figure1.1). The area is located between geographic coordinates: 52°03' north latitude and 52°16' north latitude, and 110°00' west longitude and 110°17' west longitude. It is at the northern-most apex of what is commonly referred to as Palliser's Triangle or as called by Captain John Palliser, "The Canadian Desert" (Morrison and Kraft 1994:21).

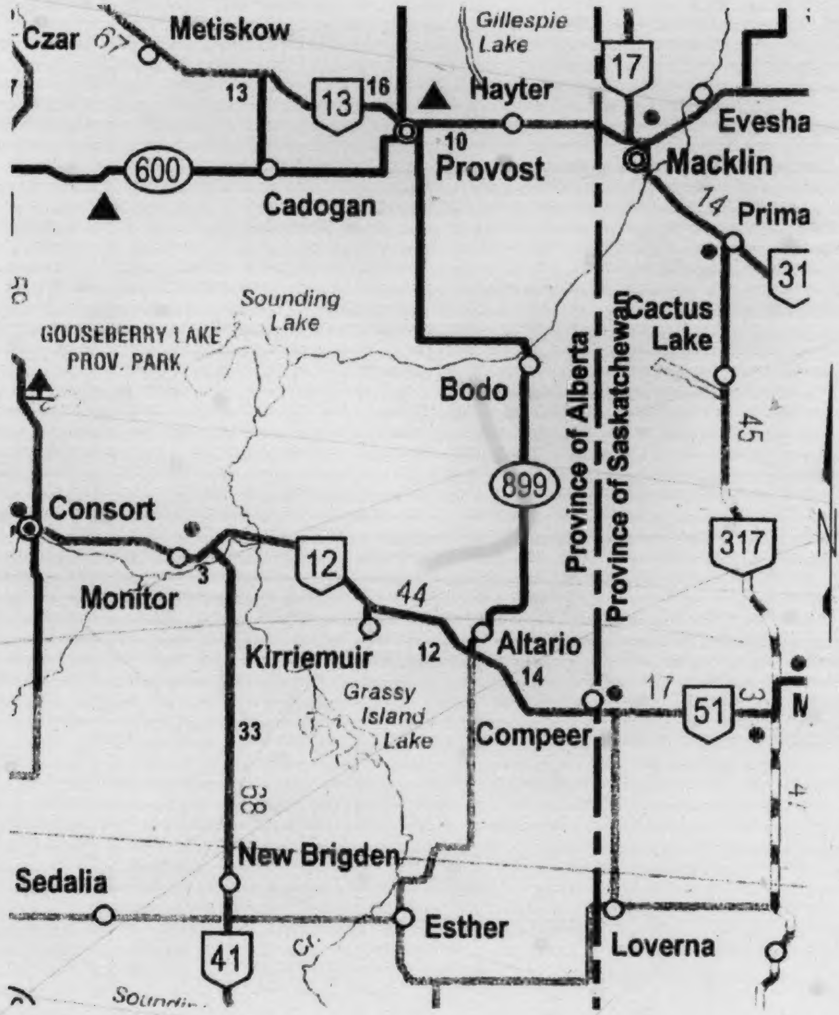
The 558 square kilometres (km^2) research area is part of the Eastern Alberta Plains, and is within the self-contained hydrological system of Sounding Creek Basin (Figure 1.2). The Eastern Alberta Plains, one of seven physiographic sub-regions of Alberta, is within the Prairie Plains region of the larger Interior Plains of Canada (Pettapiece 1989). While Sounding Creek Basin does not drain into any major river; it is part of the much larger North Saskatchewan River Basin and is located southwest of the Battle River Sub-Basin within the Provost-Coronation-Oyen region of east-central Alberta (Alberta Environmental Protection 1996: 12). A perennial watercourse known as Eyehill Creek that begins at Manito Lake, Saskatchewan, flows from a south-westerly to a north-easterly direction, and ends at Sounding Lake, Alberta bisects the area. Farms and ranches located in township 36, 37, and 38, between ranges 1 to 2, west of 4th Meridian were included in the research area.

Theoretical and Conceptual Framework

Historical Ecology: Climate, Weather and Place

Just as human societies have ongoing contact with and impact on the land, climate, plant, and animal species in their vicinities, these environmental elements have reciprocal impacts on humans. The study of human-environmental interactions has traditionally been a central concern of ecological and, more recently, environmental, anthropology (Orlove 1980; Kottack 1999; Moran 2000). Ecological anthropologists follow various theoretical and methodological touchstones depending on their research question. They consider some of the main cultural and social aspects of human-environmental interaction, such as social organization and ecology, alternative forms of land use and management, impact of processes of globalization on human relationships with the environment in a number of non-western societies, and cultural dimensions of humans' adaptability to their environment. Overall, ecological anthropologists view human-environmental interaction in a very broad way that includes material, technological, and organizational elements, in addition to symbolic aspects created by cultures.

Throughout the 20th century, ecological anthropology has seen numerous shifts on its theoretical and methodological terrain. While I do not wish to reiterate what numerous authors (Vayda and McCay 1975; Bennett 1976; Orlove 1980; Biersack 1999; Kottack 1999; Little 1999; Scoones 1999; McGee and Warms 2000; Moran 2000) have already critically and thoroughly outlined, I do want to draw attention to the reflections of Tori L. Jennings (2002). Jennings argues that a landscape-based approach to human-



Czar
67
Metiskow
13
13
16
Hayter
Gillespie Lake
17
Evesha
10
Provost
600
Cadogan
Macklin
14
Prima
31
Sounding Lake
GOOSEBERRY LAKE PROV. PARK
Cactus Lake
Bodo
45
899
Province of Alberta
Province of Saskatchewan
317
Consort
Monitor
3
12
44
Kirriemuir
12
Altario
14
Grassy Island Lake
17
51
Compeer
33
New Brigden
Sedalia
Esther
Loverna
41

Figure 1.1: Location Map
(Alberta Motor Association 2005 Road Map)

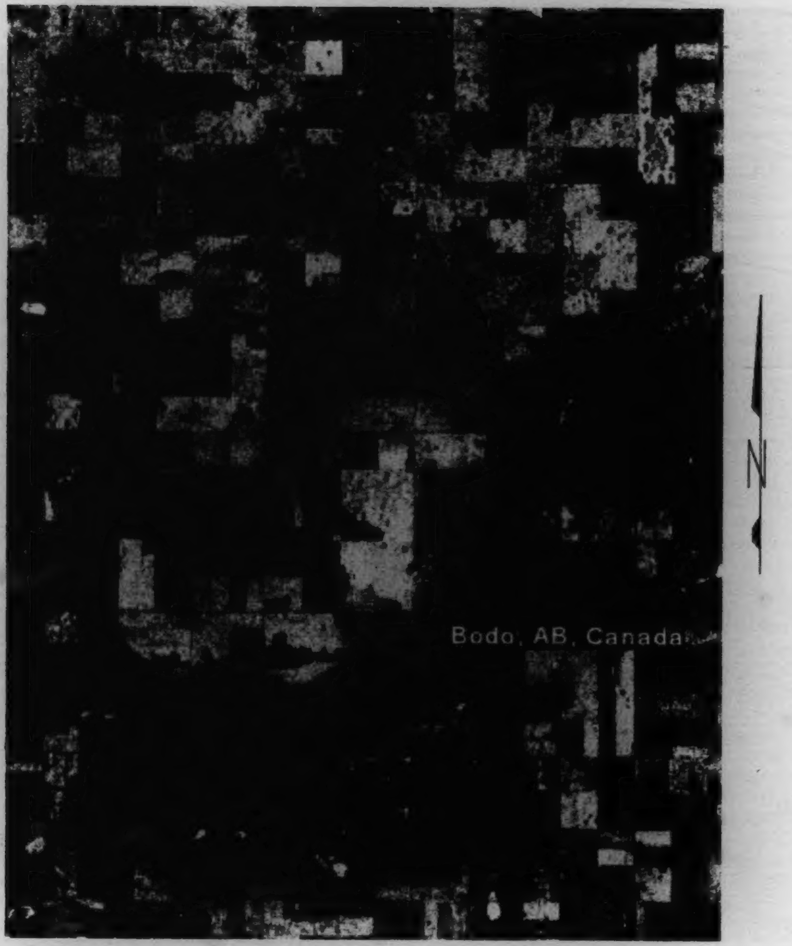

Bodo, AB, Canada
N

Figure 1.2: Location Map – Satellite Image
(2007 Europa Technologies, Image 2007 TerraMetrics)
Image accessed: April 7, 2007 - GoogleEarth

environment interaction can be applied to view "climate [as] not merely a physical phenomenon, but part of the 'socially constructed spaces' through which humans create a narrative about their world and themselves" (Jennings 2002:59-60).

Jennings makes two arguments for using a landscape-based approach to study human-environmental interaction. One argument addresses the materialist and objective leanings of human adaptability analyses in ecological anthropology (2002:60). Although human-ecological researchers describe and analyze social, political, and economic elements of human adaptability, their research remains methodologically and epistemologically biased to political-economic and material studies despite their commitment towards subjective meanings (2002:60). Jennings postulates that human adaptability research may become redundant if ecological anthropology does not address its theoretical issues with the subjective and interpretive domains of human-environmental interrelations.

Jennings' second argument promotes studies of locally inscribed perceptions of climate that inform decision-making under environmental stress of climate uncertainty and variability (2002:59). Referencing several researchers who have been advancing a landscape-based approach since the early 1990s, Jennings indicates that research that investigates people's perceptions about climate would benefit from such an approach because it already refers to empirical properties of the biophysical environment, and the interacting cultural properties (2002:60). Embedded in landscapes are cultural meanings that include both utilitarian and intangible values that emphasize people's connections to place. Socially (re)constructed and imbued with meaning, cultural landscapes are influenced by social group identity, cultural beliefs, gender, familial ties, and how people perceive, experience, and value their landscape. Jennings posits conceptualizing climate and weather, like landscape, as a context for cultural meaning in human decision-making under environmental stress. Historical ecology emphasizes that climate and weather, like landscapes, are not simply inert containers for biophysical features and measurable attributes; climate and weather are abstractions that are constructed – and continuously reconstructed – through cultural processes that assign meaning.

In this thesis, I apply historical ecology to consider the climate and weather as a culturally constructed place (Jennings 2002). Three fundamental premises establish historical ecology as a landscape-based approach to studies of human-environmental interaction. First, this approach recognizes that humans are part of the ecosystem and that any consideration of the diverse and complex interaction of humans to the environment should work within a framework that integrates both the biophysical and cultural realms. Second, historical ecology recognizes the dynamic temporal interplay of biophysical and cultural processes and that the effects of human-environmental interactions during any period influence subsequent interactions. Third, historical ecology is rooted in place. Human activity occurs in particular geographic locations but also it has links to neighbouring local scales, and reaches to regional, national, and even global scales.

Key Elements of Place

Place, geographer Robert Sack (1992:1) describes, is a "fundamental means by which we make sense of the world and through which we act". Place informs who we are and thus how we are to behave – in short, to be somewhere is to be someone. More importantly, place is also imbued with culturally (re)constructed expectations of particular behaviour, perceptions, and experiences. For example, a commercial airplane in a city airport allows people to travel to another city or country; the same airplane in a museum of aviation invites people to learn about the history of aviation technology. Although the same physical attribute (the airplane) exists in both places (an airport and a museum), prescribed differently in each place are the identity of the people, their behaviours, experiences, perceptions, and the meaning of these. The same argument of place and cultural meaning applies to weather and climate. For example, for many urban dwellers, hot and dry summer weather means more opportunities to enjoy outdoor leisure activities, such as golf, bicycling, or yard work; the same weather to a prairie farmer means grasshoppers, low soil moisture, and dry, brittle pastures.

Place-based researchers locate place at the intersection of three areas of human behaviour (Figure 1.3) (Canter 1977; Relph 1976; Sack 1992). *Biophysical attributes* include naturally occurring and human-made physical features, and processes such as climate and weather events, hydrologic regimes, animal and human migrations, and so on. *Social-political processes* takes in a variety of types of human interactions, from familial relations to agriculture producer conflicts to political power plays. These include formal and informal rules (statues, regulations, treaties, societal norms, and the like) governing conduct and behaviour. *Social and cultural meanings* are the ideas, values, and beliefs that order the world. Each area provides a particular form of information that allows people to define who they are and how they must behave in that place.

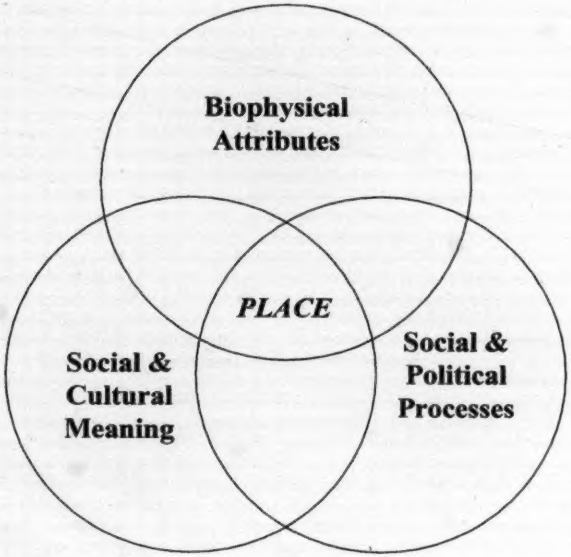


Figure 1.3: Schematic of place at the locus of areas affecting human behaviour.

In this thesis, I focus on *social and cultural meaning*, and as such, exclude the biophysical attributes and social-political processes. Substituting *place*, at the intersection of the three areas affecting human behaviour, is *climate and weather* (Figure 1.4). This focus is necessary to keep data collection and analysis at a manageable level for the present context, and in no way assumes relative importance of the two former over the latter.

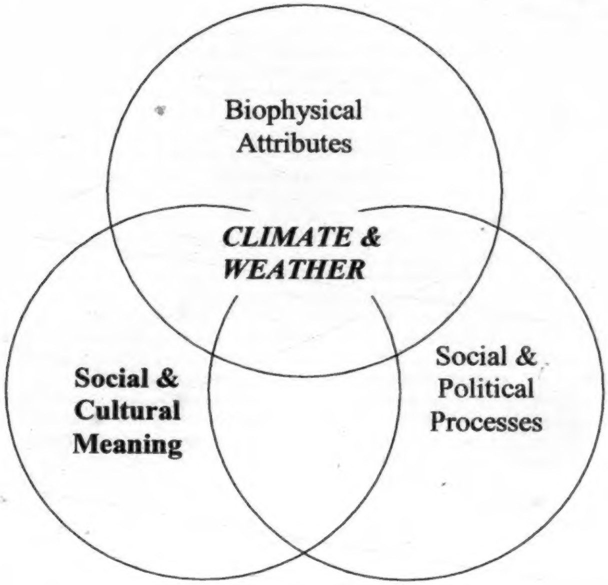


Figure 1.4: Schematic of climate and weather at the locus of areas affecting human behaviour

Literature Review

Anthropology of Climate and Weather

The relevance of anthropological research, within climate and weather studies, is its focus on local community and culture as a key dimension in mediating human-environmental interactions. Some consideration of this focus serves to elaborate the importance of an anthropological approach and perspective in contemporary thinking about local scales of analysis to global climate issues. It also serves to demonstrate the way in which a perspective on social context, cultural understandings, and local human-environmental interactions are influencing climate research.

Roncoli and Magistro (2000) address both the difficulties and challenges practicing anthropologists face in the field of climate science. The authors point out that difficulties lie in issues of authority in public debates, disproportionate funding between social and physical sciences, and viable collaboration across disciplines characterized by different discourses, theoretical underpinnings, methodological approaches, and scales of analysis. They are particularly critical of scientific findings that use anthropology as "nothing more than . . . a 'cultural' rubber-stamp" (Roncoli and Magistro 2000:2). Emphasizing their frustration is their observation that these barriers have rarely resulted in anthropology as an "effective influence in the international arena"[2] (Roncoli and Magistro 2000:2); however, the authors note that these difficulties are not preventing anthropological contributions to the field of global climate science. For example, economic/ecological anthropologist Emilio Moran (Indiana University) directs the Anthropological Center for Training and Research on Global Environmental Change. Moran's research combines remote sensing and ethnographic field methods of data gathering and analysis to document human and biophysical processes associated with deforestation.

Roncoli and Magistro (2000) also discuss new challenges facing anthropologists. One of these challenges is to bridge information production and exchange between climate scientists and local residents. Anthropologists must confront the responsibilities of mediating between traditional, rural communities in developing countries, and the upper echelons of policy-making, global science, and high-tech communication. Furthermore, the products of science are both a vital resource and powerful symbol; access to and use of it have profound ecological, economic, political, and cultural implications. The message Roncoli and Magistro (2000) are highlighting is that these challenges call on anthropologists to not only be informed of the multiplicity of elements in climate change research, but also to be clear of where their disciplines' commitments and accountabilities lie.

Magistro and Roncoli state, "that localized scales of analysis, that have been the hallmark of anthropology, can complement global modeling exercises that cannot fully capture the complexities of real life decisions" (Magistro and Roncoli 2001:91). The contributors in this special edition of *Climate Research* draw from interdisciplinary research. They demonstrate that anthropological inquiry into local, climate-based perception and behaviour around the world are growing in parallel with the scientific focus on climatic variability and its policy implications. Moreover, they not only demonstrate the advantage of combining qualitative and quantitative methods, they also illustrate how an anthropological perspective of the cultural, economic, and political context of human adaptation can inform policy related to climate variability and change. In their introductory paper, Magistro and Roncoli (2001) conclude that anthropology's long-standing tradition of studying social vulnerability and human adaptability to environmental stresses can facilitate communication of climate information to policy-makers by ensuring consistency with local knowledge frameworks.

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[2] Magistro and Roncoli point to the lack of, or even presence of, anthropologists among the two thousand members of the Intergovernmental Panel on Climate Change (IPCC). The IPCC is a scientific body created in 1988 by the United Nations and the World Meteorological Organization to assess risk of human-induced climate change and advise on policies to control global warming. The IPCC, McIntosh et al criticize, takes a 'macro-societal technological-economic approach" to human-environmental interaction, which "inherently works" but is "primarily incomplete" because it "fails to reflect much of the human experience" (McIntosh et al 2000:6).

In addition to papers in peer-reviewed journals, essays in edited volumes attest to the importance of climate and weather as sites for anthropological investigation of the human-climate interaction. For example, *Weather, Climate, Culture*, a volume edited by Sarah Strauss and Benjamin Orlove (2003), offers a collection of case studies from around the world that explore a range of human interactions with and through weather and climate from an applied anthropological perspective. The editors state the goal of this volume is to:

> . . . present an introduction to an emergent area of inquiry, the anthropology of weather and climate, and to demonstrate the significance of using an anthropological eye – and ear – to understand the ways that human societies make sense of this basic aspect of their environment (Strauss and Orlove 2003:10).

The contributors demonstrate different concepts of nature and culture, both ancient and modern forms of ethnoclimatology and ethnometeorology, and link these with the political, economic, and moral dimensions of social life. Furthermore, these essays highlight the universal importance of weather and climate to human societies, and the consequent potential for comparative analysis, thus connecting practical application with a central theoretical issue for anthropologists.

Presenting a similar, although archaeological, perspective on human-climate interactions is the edited volume *The Way the Wind Blows: climate, history, and human* *action* (2000). This volume, a collection of essays edited by Roderick McIntosh, Joseph Tainter, and Susan Keech McIntosh, provides broad geographical, cultural, and temporal coverage of a wide range of human response to climate change and environmental stress. Observing the absence of human history not only from public discussions of climate change but also from most academic discourse the contributors of this volume aim "to bridge the gap between climatology and the human sciences . . . and to bring the history of human responses to climate to the international debate on climate change" (McIntosh et al 2000:1). The editors' contention is that an integration of social (anthropology and history) and physical (palaeoclimatology and palaeoenvironment) scientific approaches is essential in order to address issues related to the dynamics of climate and weather, human perceptions and responses to environmental stresses, as well as issues of multi-spatial sustainability and resiliency. One contribution made by these essays is that data from the archaeological record can significantly extend the relatively short instrumental record of climate change, thereby allowing researchers to examine the full range of long-term human and biophysical processes. More importantly, the editors' fundamental proposition is that members of human societies interact not directly with nature, but with their perceptions of nature, and they act on those perceptions often through behaviours that are vague, relative, flexible, and intangible. As such, the editors emphasize that anthropologists are in a position to grasp this "less palpable nature of human behaviour" because it is an inherent aspect of the discipline (McIntosh et al 2000:7).

The above sources indicate that a resurgence of anthropological interest in weather and climate has occurred during the past decade. A growing concern about climate change and variability among social and physical scientists, policy makers, and the public seems to drive, or at least to accompany this interest. While some anthropologists examine the contemporary social, cultural, economic, and political context of human adaptation to and perception of environmental stresses, others examine the long-term human responses to and natural processes of climate change through archaeological data and environmental proxy data. Regardless of the spatial or temporal aspect, or the context, anthropology of weather and climate provides a perspective to consider human-environmental interactions.

This thesis will contribute to the anthropology of climate and weather by considering the cultural meaning of climate that mediates human adaptability to environmental stress of interannual climate variability. Moreover, this thesis focuses on household-level behaviours and values that underlie human experiences of and interaction with environmental stress, and thus seeks to add to anthropology's contribution to global climate research.

Farm-level adaptive behaviour to environmental stress

In this section, the literature review demonstrates that rural sociologists, agricultural economists, and human geographers dominate research on farm-level adaptive behaviour to environmental stress in Canadian agro-ecosystems. Their research generally takes a strong political-economic-technical perspective, emphasizing economic decisions, task performance, government programs, farm financial management, and productive relationships both economic and technical. These researchers have successfully documented, described, and analyzed the complex economic, political, and technical possibilities of the human-environmental agro-ecosystem. Overall, their findings redress the emphasis agricultural economists place on rational choice and quantitative controls. However, what remains in farm-level adaptive behaviour research is an anthropological consideration of the human relationships and cultural practices that give climate and weather its meanings, rather than human responses to environmental stress as a crisis.

Farmers' adaptability to environmental stress of interannual climate variability, i.e. agricultural drought, is about on-farm decision-making. Beginning in the early 1990s, conceptual frameworks linked integrated numerical modeling approaches more directly to scholarship in human-environmental relations and agricultural adaptation (e.g. Chiotti et al 1997, Smithers and Smit 1997). Integrated numerical modeling approaches quantify the impacts of specified climatic changes on agricultural activities and regions. Such analyses typically involve formally linking biological process models with farm economic models and regional input-output models in order to produce estimates of the effects of specified climatic changes on farm profitability, regional food production, and national and international economic performance. This led agricultural geographers and rural sociologists to explore human adaptive behaviour, in particular farmer/rancher decisions and factors influencing those decisions, more explicitly and empirically. This literature review synthesizes some research on farm-level adaptive behaviour to environmental stress of interannual climate variability in a Canadian agriculture context.

Research by Smit et al (1996) reviewed variability in climatic conditions, as well as the relevance of human decision-making, and the role of non-climatic forces in order to document the assumptions underlying impact assessments for climatic change in agriculture. Between 1986 and 1991, the authors conducted a questionnaire survey of 120 farmers in the southern Ontario area of the North American Great Lakes basin. This survey recorded the perceptions and decisions of individual farmers. Their research builds on the analogy[3] scholarship of Michael Glantz (1991), the natural hazard literature of Ian Burton, Robert W. Kates, and Gilbert F. White (1993), and the behavioural tradition in agricultural geography and rural sociology of Gary P. Green and William Heffernan (1987), Thomas Saarinen (1966), and Barry Smit and John Smithers (1993). The focus of this research is on human behavourial responses to biophysical effects. The objective is to analyze changes reported by farmers, and reasons behind these changes in order to learn how farmers respond to a range of external climatic, political, and economic forces.

Smit et al (1996) used a conceptual model of agricultural adaptation to climatic variability to help interpret results from the questionnaire survey. They found this model to be useful in distinguishing effects and responses, particularly with exogenous (biophysical environment, government programs, economic conditions, technological and social) and endogenous (farmer, family, and farm attributes) forces of change. Empirical analysis demonstrated that variable climatic conditions over a six-year period affect many farmers in the study area, and that some farmers undertook strategic adaptations in their farm operations. However, it also demonstrated that climatic conditions influenced only one in five respondents to respond with strategic changes in their farm operations. Smit et al (1996) concluded that the results illustrate farmers do not spontaneously or autonomously adapt to changes in climatic conditions, which is an assumption inherent in many climate impact assessments. Instead, they take into consideration a multitude of forces (climatic, economic, institutional, social, technological) that are intertwined; thus, indicating the need for impact assessments to identify, rather than assume, interactions between internal and external forces and human adaptive behaviour.

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[3] Analogies have a base and a target; known facts about the base are applied to make predictions about future unobserved relationships in the target problem. When applied in climate change research analogies and analogical reasoning are heuristic devices used to understand what future climate change might be like and to provide a rudimentary approximation of some aspects of societal responses to the impacts of climate change at a regional level.

In their chapter, *Agricultural response to climate change: A preliminary investigation of farm-level adaptation in southern Alberta*, Chiotti et al (1997) examine human adaptive behaviour and farm-level decision-making by linking empirical evidence with theoretical constructs developed in the agricultural restructuring[4] literature. The purpose of their chapter is to address what the authors view as a critical gap within the literature on the impacts of climate change on agriculture, in particular the implicit assumption that climatic influences control human decisions *vis-à-vis* agriculture. Drawing from scholarship in agricultural geography and agricultural restructuring, the authors develop an integrative framework to conceptualize farm-level decision-making and adaptation that recognizes land management decisions as socially constructed, environmentally influenced, and historically contingent (Chiotti et al 1997). These authors only explore land management responses; however, farmers undertake numerous adaptation options. Other options include technological development (crop, resource management innovations), government programs (agricultural subsidy, support and incentive programs), private insurance, farm production practices (land use, irrigation, timing of operations, farm production), and farm financial management (crop insurance, income stabilization programs, household income) (Smit and Skinner 2002). Extending this framework to include farm-level adaptation to climate change, the authors raise various questions regarding the dialectic interactions between climate and modern commercial agriculture. For example, how important is climate relative to other societal forces confronting farmers; and, in response to climate, what types of adaptations do farmers engage in and what land management responses are sustainable under an altered natural and social environment (Chiotti et al 1997:207).

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[4] Agricultural restructuring refers to the adjustments that farm community has made in order to cope with changing and demanding economic, technological and market environments that have developed in the post-World War II period.

A number of studies have documented, described, characterized, and explained possible forms and types of agricultural adaptation (Smit 1993; Kandlikar and Risbey 2000; Smit et al 2000; Skinner et al 2001; Smit and Smithers 2002). Recently, the focus of agricultural adaptation and interannual climate variability research is on which adaptation options the various stakeholders who undertake decisions in the agricultural sector adopt, promote, and/or implement. Examining this issue is a federal government-supported report, *Adaptation to Climate Change in Agriculture: Evaluation of Options*, by Dolan et al (2001). The focus of this report is on planned policy responses undertaken or promoted to adapt to climate change risks in the Canadian agricultural sector. The researchers reviewed current adaptation research from the climate impact, adaptation, and vulnerability scholarship, and incorporated information and insights from various stakeholders in the agricultural sector. This report obtained data through workshops, questionnaire surveys, and focus meetings with representatives from the scientific community, producer organizations, farm groups and government agencies, and individual producers.

The purpose of the report was to "develop a framework to consistently and systematically evaluate adaptation options in agriculture to climate change" (Dolan et al 2001:iv). The intention of the evaluations was to assess the overall merit, suitability, utility, or appropriateness of potential adaptation strategies or measures. Expectation of this evaluation method or framework was to assist in screening potential adaptation options, and provide direction as to which adaptation should be encouraged or implemented (Dolan et al 2001). The researchers adopted a multi-criteria suitability assessment as an alternative to research that evaluates the suitability of adaptations according to one criterion only such as economic efficiency, effectiveness, or institutional compatibility (Carter et al 1994; Frankhauser 1996). Implicit to all such evaluations is an assumption that suitable and recognizable adaptive strategies make sense to government agencies and farmer producers. This report argues that this assumption may be problematic. The researchers evaluated selected potential adaptations from the perspective of government agents and farm producers relative to criteria drawn from scholarship and workshops. The report suggests that, while multi-criteria evaluative frameworks can serve to identify adaptations generally suitable for managing climate-related risks, they are less effective at identifying adaptations that are suitable for managing multiple risks, be they changes to government subsidy programs, downturns in commodity markets, or the loss of export markets due to livestock diseases. Even more problematic is their limited capacity to identify adaptations that are suitable for responding to multiple opportunities.

In their conclusion, Dolan et al (2001) corroborate other research findings that demonstrate agriculture producers experience climate and weather risks in the context of a wide range of other conditions that include: economic, social, political, and technological (Chiotti and Johnston 1995; Smit et al 1996; Smithers and Smit 1997; Brklacich et al 2000; Kandlikar and Risbey 2000). Furthermore, considering the highly integrated nature of the agro-ecosystem, decision-makers are evaluating options to adapt to such risks in the context of these broader decision processes. Therefore, what *should* happen, according to the evaluation framework, at the farm-level given the risks associated with interannual climate variability may not coincide with what *actually* happens. The evaluative framework in the report by Dolan et al (2001), and others like it, are not structured to capture the complexity of human adaptive behaviour and decision-making even though this is what they are designed to do.

Contemporary government policy-makers and agricultural producers are dealing with the prospect of an increasingly uncertain and variable climate, and viewed by some as a potentially serious challenge to the viability of the current agro-ecosystem in Canada. Currently, there are several agricultural geographers and rural sociologists researching climate change and agricultural adaptability. Such researchers include: Chiotti et al (1997), Bryant et al (2000), Smit et al (2000) Smit and Skinner (2002) Wall et al (2004). These researchers are documenting farmer responses to climatic variability and uncertainty, the role of other forces as mediating factors shaping these responses, and the value, suitability and actual adoption of particular agricultural adaptive strategies to environmental stress.

This chapter served as an introduction to my thesis research, it presented the statement of purpose, thesis objectives and questions, clarification of terms, selection and location of the research area, theoretical and conceptual framework, and literature review. The following chapter provides a frame of reference to the extreme and variable climate of the western Canadian Prairies through an overview of exploratory expeditions, homesteading and agricultural development. This background chapter also gives a brief description of the physiography, biophysical environment, and agro-ecological land classification. The chapter concludes with an overview of the community of Bodo, Alberta.

CHAPTER 2

BACKGROUND

> *To ask, "What are the Canadian Plains?" is to evoke answers as variable as day-to-day temperatures in February in the chinook belt of southern Alberta. You could be told that the Canadian Plains region is the grasslands, or the steppe, or the prairie and parkland, or the wheat-growing and ranching region of Interior Canada. You might even be informed that the Canadian Plains are more than that, and are, in fact, those lands in western Canada bounded on the east by the Canadian Shield, on the west by the Canadian Cordillera, and on the south by the Canada-United States boundary. Further probing might disclose that the region occupies an area exceeding one million square kilometres and is some 1,300 kilometres wide at its base along the 49th parallel, from where it extends north for over 2,600 kilometres to the Mackenzie River Delta. However interesting these answers might be, they nevertheless only tell* where *the Canadian Plains are, not* what *they are!*
>
> Mitchell 1984

> *Coming to Bodo is like going to the Bermuda Triangle. You wouldn't leave. I don't know what it is. Something draws you here and keeps you here.*
>
> *Research Participant-13, 22 August 2004*

Generally described as a climate of extremes, the western Canadian Plains[5] have a continental climate that grades from sub-humid to semi-arid and experiences highly variable weather.[6] This climate has both 'normal' and 'abnormal' seasons of low humidity, high number of daylight hours, timely rains, warm summer days, cool summer nights, winter and spring blizzards, short- and long-term drought, spring floods, hail storms, great variation in temperature and precipitation, gusty winds, intense thunderstorms, and occasional tornadoes (Friesen 1984; Paul 1984; Maybank et al 1995; Jones 2002). This is a climate compellingly argued as both a resource and a constraint to western Canadian Prairie agriculture (Friesen 1984; Paul 1984; Jones 2002). In addition, this is a climate viewed as a backdrop to elements of social and political history of western Canadian agricultural development (Paul 1984; Sauchyn and Beaudoin 1998). These elements include government agencies and programs, and dryland agricultural practices. Against this climate backdrop elements of human experience, perception, and response were, and still are, made regarding the agricultural development of the western Canadian Prairies.

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[5] Western Canadian Plains and western Canadian Prairies are used interchangeably. For the purpose of this thesis, the notion of western Canadian Plains defines an ecological region and the western Canadian Prairies as a historical and social construct.

[6] Weather and climate continuously and constantly interact in human affairs. In general, weather is what is happening in the atmosphere now and over a short time period and described as wet or dry, hot or cold, cloudy or clear. Climate is the long-term average weather conditions describing what generally happens in an area. Climate is what you expect – weather is what you get!

Overview of Euro-Canadians in the Western Canadian Prairies

Exploratory Expeditions

Between 1857 and 1860, two separate groups conducted exploratory expeditions to learn more about the agricultural potential of the western Canadian Prairies. Captain John Palliser and his staff conducted, under commission from the British government, explorations primarily in the valleys of the North and South Saskatchewan Rivers. Leading the Canadian expedition was civil engineer S.J. Dawson and geologist Henry Youle Hind. These two groups never met or corresponded, however each group built upon the reports of the other (Friesen 1984). A third and later expedition (between 1870 and 1880), led by Sir Sanford Fleming, a railway surveyor and construction engineer, conducted extensive surveys to establish a satisfactory route for the Canadian Pacific Railway (CPR). However, observations and interpretations between the earlier two expeditions and the later one did not agree, and not all recommendations were in favour of agriculture development in the western Canadian Prairies.

Professor James Hector, geologist and naturalist for the Palliser expedition, determined that a portion of the "Great American Desert" extended into the northern Canadian Plains. The final report of the Palliser expedition concluded agricultural development would be limited essentially to the "fertile belt" of the aspen parkland. Hector described the area south of this fertile zone as "arid country" (Warkentin 1964) and designated it as the Arid Plains, the Canadian Desert, or in popular parlance, Palliser's Triangle (Spry 1995). Hector described this arid area as, " . . . a triangular region, its apex reaching to the 52nd parallel, while its base, applied along the 49th, extends between longitude 100 degrees west and 114 degrees west", and concluded that ". . . although there are many fertile spots throughout its extent, can never be of much advantage to us as a possession" (Warkentin 1964:79). Hind reached similar conclusions, describing the region of the Canadian Plains west of the Missouri Coteau, " . . . from the character of its soil and the aridity of its climate . . ." as " . . . permanently sterile and unfit for the abode of civilized man" (Warkentin 1964:80).[7]

In 1872 Professor John Macoun, botanist and naturalist, took part in Sir Fleming's railway surveys. Macoun wrote in various reports and spoke at numerous public lectures that the western Canadian Prairies were ideally suited for agriculture (Friesen 1984). He concluded that settlers could do well in the southern regions for it was clearly not the "arid desert" as Hector and Hind separately reported it to be (Warkentin 1964). This was good news for CPR directors: a railway built across the southern portion of the prairies, via Calgary, rather than taking the longer, northern route via Edmonton, was cheaper (Friesen 1984). This southern route was essentially for economic, political, and strategic reasons; Macoun simply provided the agricultural justification. Despite Macoun's overwhelming support and encouragement, nearly two decades would pass before widespread settlement and farming and ranching would begin in the western Canadian Prairies.

Friesen and Spry have pointed out that both expeditions were in the region between 1857 and 1858 (Friesen 1984; Spry 1995). Historical and environmental data have shown that during the two expeditions the southern region of the northern Canadian Plains was experiencing a prolonged period of drought (Sauchyn and Beaudoin 1998; Beaudoin 1999; Sauchyn et al 2003). Moreover, these data not only indicate that periodic droughts have occurred throughout the 19th century, the data also indicate that it was the coolest interval in the post-glacial period (Beaudoin 1999). Cooler temperatures were probably beneficial for the conservation of soil moisture in all areas except marginal and particularly sensitive areas like Palliser's triangle (Beaudoin 1999). While Hector and Hind traveled the northern Canadian Plains during one of these drier periods (Friesen 1984; Spry 1995), Macoun came through during a time of cooler and moister climate.

The extreme variation in both temperature and precipitation is an important characteristic of western Canadian Prairie weather. This variation occurs temporally within a season or year and from year to year had important implications for the homesteaders and early agricultural development. As was discovered by these early Euro-Canadian explorers and later by homesteaders and early agriculturalists, year-to-year variation in weather is one of the most difficult factors when assessing agricultural potential on the western Canadian Prairies.

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[7] Palliser's Triangle has developed into one of the most important in Canada for production of grains, such as wheat, barley, and oats, and oilseeds, such as canola (Statistics Canada 2001).

Homesteading and Agricultural Development

The Dominion Lands Act of 1872, a landmark legislation created to attract European, eastern Canadian, and American immigrants to homestead in the western Canadian Prairies, was not the initial success the government had hoped. The government of the new nation-state slowly recognized that simply legislating free homesteads would not win the attention of prospective settlers at home or abroad (Friesen 1984; Francis 1989). Between 1897 and 1929, Sir Clifford Sifton, as head of the Department of the Interior, began aggressively promoting settlement and agricultural development in the western Canadian Prairies. Partially based on qualitative observations and accounts of Hector and Hind, Sifton's campaign strategy included propaganda literature.

Printed in a wide range of languages, propaganda pamphlets promoted the advantages and virtues of the prairies. These pamphlets had a standard format: an introduction describing the western Canadian Prairies as a land of opportunity; an outline detailing climate, soil, crops; instructions explaining how to locate a homestead and how to get started; and, listings of transportation, social, and cultural facilities. However, with the aim of encouraging settlers to the western Canadian Prairies, this matter-of-fact information was embellished (Francis 1989). For example, western prairie climate was described in terms of its positive effect on farming and settler's physical well-being; negative words like "snow" and "cold" were replaced with "bracing" and "invigorating" (Friesen 1984; Francis 1989:110). Propaganda promoted the northern latitude and northerly climate of the western Canadian Prairies as a benefit, not a drawback. As pointed out by Hargreaves (1957) the propagandist extolled the virtues of fertile land and nutritious crops, but failed to mention droughts, grasshoppers, and isolation that hampered farming efforts.

In the beginning of the 20th century, the network of Dominion Experimental Farms developed a number of dry land agricultural practices and wheat breeding programs. These practices and programs were promoted by the Department of Agriculture, encouraged by agricultural societies and dry land farming experts, publicized by local newspapers, and implemented by local farmers (Jones 2002). Dry land practices included: subsurface packing and surface mulching that left the land covered in a light layer of dust, and deep ploughing that was to facilitate penetration of rain into the soil and prevent excessive run-off although it did expose the soil to moisture loss (Jones 2002).

During the first period of prolonged drought (1917-1926) when crops repeatedly failed each year and the area of land under drought conditions increased, prairie farmers were chastised for being poor farmers, and for not following the advice and recommendation of government farm experts in the Department of Agriculture (Jones 2002). Proponents of dry land practices repeatedly reminded farmers that early ploughing and thorough tilling were the principal controls for drought. Even a 1922 report from the Survey Board for Southern Alberta reminded farmers that agricultural practices developed by experimental farms were necessary to improve soil conservation. The report also encouraged a diversified mix of crops and livestock, spring fallow, and irrigation.

Resentment, anger, and frustration were common feelings among many prairie farmers during this drought period (Jones 2002). Water shortages and poor livestock prices in the 1920s and 1930s precluded stock keeping. Mixed farming in the western Canadian Prairies was more costly than wheat farming because it required buildings to shelter livestock, corrals, fences, windmills, breeding stock, and labourers. In general, it meant harder work and longer hours along with natural hazards: predators, infections, epidemics, and weather-related problems (Jones 2002). One farmer, R. Fenerty had written to F.H. Auld, Saskatchewan Deputy Minister of Agriculture (1918), expressing his annoyance and disappointment with government officials who were ignoring the opinion and experience of local-level farmers. In his letter, Fenerty criticized W.R. Motherwell, a farmer, politician, and promoter of dry land farming techniques, for blaming crop failure on ignorant and foolish farmers who would not implement his recommended practices. Fenerty pointed out that those farmers implementing "the good" practices" of summer fallow and tillage, were doing less well than the "oft-maligned, indifferent farmers" were (Jones 2002:139-140). According to Jones the thought that prairie farmers had discovered and understood the "reality of the desert first" unsettled the farm experts (Jones 2002:147). The divisive experiences, opinions, and responses from climate to farm practices between local prairie farmers and government farm experts are recurrent themes in the history of agricultural development in the western Canadian prairies (Jones 2002).

In the mid-1930s, federal and provincial governments created programs and agencies to assist western Canadian prairie farmers. One example is the 1935 Prairie Farm Rehabilitation Administration (PFRA). This was a federal agency created to salvage the worst agricultural areas in the western Canadian Prairies. Federal grant funds permitted the establishment of experimental substations to train farmers dealing with severe soil erosion. Programs were set up to deal with water conservation (irrigation projects) and land reclamation (community pastures). In addition, the Alberta provincial government implemented several resettlement schemes. Land management agencies had the authority to withdraw land from agricultural production and control grazing rates. Methods of cultivation switched from the plough to cultivators, leaving stubble near the surface. Ongoing research at experimental farms developed rust resistant wheat varieties, removing one of the greatest hazards to prairie wheat production. However, successful soil reclamation projects, water conservation and land use schemes could not correct the errors of the earlier generation of policy-makers.

Overview of Bodo, Alberta

In 1883, Dominion Land Surveyors arrived in the locality of the modern hamlet of Bodo. These surveyors established control lines on which to base the township and settlement surveys. By 1885, a few pioneer settlers were homesteading in and around the locality. Anglo-Saxon immigrants from Britain, eastern Canada and United States slowly infused into the area after 1897. However, widespread immigration did not happen until after 1909. Two major ethnic groups immigrated to the Bodo locality: Russian-born Germans (Odessa area), and Norwegians from either Norway or mid-western United

States. While most members of this agricultural community are second and third generation farmers/ranchers, others, usually from farming and/or ranching communities themselves, have moved into the area after marrying a local member of the community.

Bodo was the original site of the rural post office known as Scheck. In 1931, the Canadian National Railway (CNR) completed the Bodo railroad. The track originated from Unity, Saskatchewan and was to continue west from the hamlet towards Alliance, Alberta; however, at the onset of the Depression the CNR could not finance the completion of the line (Research Participant-5, 4 August 2004). The Bodo railroad was the 'end-of-the-line' of CNR track. In the following year (1932), CNR established Bodo as a hamlet. With the completion of the Bodo railroad, local farmers began hauling grain, cream, and livestock (cattle and pigs) to Bodo rather than to Altario, a small hamlet approximately 32 kilometres (km) directly south, or to Macklin, a town approximately 23 km northeast in Saskatchewan. Every Friday a steam-train delivered bulk fuel, mail, and groceries, remained overnight, and departed the following morning (RP-5, 4 August 2004). In addition, the Friday train would pick up rural residents from communities along the railroad and transport them into Bodo for that evening's community hall dance (Research Participant-5, 4 August 2004). Revellers would spend the night dancing and socializing, leaving the following morning: *"Hop on the train and sleep on the way home!"* (Research Participant-5, 4 August 2004).

Changes in farm numbers, land, population, agricultural receipts, capital and operational arrangements show the emergence in the western Canadian Prairies of an intensive, capitalized agri-business made up of fewer but larger operations after World War II. Along with many other agricultural producers, farmers and ranchers in the Bodo area compete in demanding national and international markets rather than in the isolated local markets that supported many of them in the past. Agriculture changed from a way of life and a part of the community to a large-scale, specialized, intensive business undertaking. Family farm and ranch operations are now engaged in intensive and extensive land management practices sustaining soil fertility and mono-cropping through herbicide, pesticide, and fertilizer treatments that make marginal soils productive. The locality's contemporary economic base is primarily devoted to market-type farming (grain, oilseed and wheat crops) and ranching (cow-calf operations) (Statistics Canada, 2001). However, natural gas and conventional crude oil exploration and development in the area provide a secondary economic base (Statistics Canada, 2001).

By the early to mid-1970s Bodo was a community that had two general stores, the post office, a gas station and mechanic shop, and a church (Roman Catholic. These places of business and worship were common venues for community members to not only meet and discuss family, community, and farm affairs, but also to maintain and manage social group obligations and relationships. One particular place were farmers and ranchers would meet, and still meet, is in their fields and on the rural roads. In addition, Bodo had three, operational grain elevators until they were closed in 1980, and then demolished in 1984. The school had kindergarten to grade 12 students who came from within town and who were bussed in from neighbouring farms. However, the contemporary social landscape of Bodo is one that is similar to many small Canadian prairie communities: out-migration, business closures, and vacant residences. One of the two general stores closed, the other store remained open but with fewer general supplies. Over time, this one store was only stocking essential goods. With the closure of the post office, this remaining store became the local weekly postal drop-off and pick-up. When the gas station closed and the mechanic moved out of town, the community and out-of-town traffic such as short- and long-haul truckers lost a local and convenient means of automobile maintenance and fuel. With the closure of the church local worshippers went to Provost. The loss of connection people had with their local community was a concern for individuals not the extra travel time. As families were moving out of the community and farms were becoming fewer but larger the school in Bodo was loosing students. When the school closed, students were bussed into Provost. Presently the school remains open and the Bodo Community Association manage the building that is rented for social events such as wedding receptions and family reunions. In addition, the Bodo Archaeology Field School rents space in the building during its summer field season.

Overview of Physical Environment

The research area has a continental climate characteristic of the Canadian prairies: sub-humid to semiarid with temperature extremes, water deficit, and high evapotranspiration. Brown and Dark Brown Chernozemic soils dominate, along with the odd area of Solonetzic soil. Two ecoregions dominate the thesis research area: open prairie grassland with semiarid moisture conditions, and a transitional ecoregion of boreal forest and open prairie grasslands. Landforms feature rolling and hummocky uplands, and undulating and level plains with topography that ranges from 680 metres to 725 metres above sea level. See Appendix A for further details.

Three bedrock formations[8] appear in the research area. The lower formation is a marine deposit known as the Lea Park Formation. Overlying the Lea Park Formation is the Belly River Group. Included in the Belly River Group are a marine and continental deposit of the Foremost Formation, and continental deposit of the Oldman Formation (Hydrological Consultants Ltd. 1999). Only the marine sediment of the Foremost Formation and the Oldman Formation exist throughout the research area. The third and uppermost formation is a marine deposit known as the Bearpaw Formation. Details of these bedrock formations are in Appendix B.

The Buried Bodo Valley[9] (BBV) linear bedrock low is located in the research area. Although it is mainly found in township 37 and 38, range 1, west of 4th meridian, it is also found in the following areas: northwest corner of township 36, range 1; north half of township 36, range 2; the east quarter and southwest corner of township 37, range 2; and, the southeast corner of township 38, range 2. The BBV is approximately five to 11 km wide, with local relief less than 60 metres, and a southwest to northeast orientation. The lowest surficial deposit[10] overlays the bedrock surface. This lower deposit includes pre-glacial sand and gravel deposits of fluvial origin. The upper surficial deposits are less than 40 metres thick and deposition is mainly due to glacial activity (till with sand and gravel deposits of melt-out origin). The remainder of the research area contains lower surficial deposits of pre-glacial fluvial and lacustrine (clay, silt, and fine-grained sand) origins, and upper surficial deposits of glacial (till and meltwater) deposited material.

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[8] Bedrock formation data compiled from a regional groundwater assessment report (Hydrogeological Consultants Ltd. 1999).

[9] Buried Bodo Valley is the minor, linear bedrock low in Provost County. Buried Wainwright Valley, the major linear bedrock low, is located in the northern portion of Provost County. Published bedrock topography maps indicate the presence of BBV, but have never named it. For the purposes of report file 97-103, Hydrogeological Consultants Ltd named the Buried Bodo Valley after the closest town: Bodo (Poulter 2005: pers.comm.).

[10] Data for the surficial deposits compiled from a regional groundwater assessment report (Hydrogeological Consultants Ltd 1999).

Agro-ecological Land Classification

Agro-ecological land classification is a hierarchical system of dividing geographic areas into a series of landscape types, or agro-ecosystems types, which reflects overall patterns of bio-geographical features (geology, geomorphology, physiography, hydrology, pedology, climate, and vegetation). The classification frequently includes a hierarchy of units depending on size, scale, available information, and purpose of classification. In Alberta, agricultural authorities use two systems of agro-ecologically-based land classification. One is the Agricultural Resources Areas of Alberta (Pettapiece 1989a) map that emphasizes broad areas of agricultural potential based on similar eco-climates, physiography, and general soil characteristics. The other system is the Agricultural Regions of Alberta Soil Inventory Database (AGRASID).[11] AGRASID provides detailed soil and landform inventories, and ecological land characteristics[12] within a digital database of geographic information system coverage and relational data files. This thesis also uses Achuff's *Natural Regions, Subregions and Natural History Themes of Alberta: A Classification for Protected Areas Management* (1994). Since the setting for this research is within an Alberta farming and ranching community it was not only considered applicable, but essential that identification and description of soil, landforms, climate, and agro-ecological land reference data used by agricultural authorities.

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[11] AGRASID is the result of the Canada-Alberta Environmentally Sustainable Agriculture (CAESA) Soil Inventory Project involving: the Alberta Research Council; Alberta Agriculture, Food and Rural Development; Agriculture and Agri-Food Canada – Land Resource Unit, and private sector consulting firms. (Accessed May 22, 2005. Available online: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sags3254?opendocument)

[12] AGRASID adopted the standard terminology and associated ecological land description of the *National Ecological Framework for Canada* (Ecological Stratification Working Group 1995), which are based on the Ecoregions Map of Canada, and developed by: Environment Canada; State of the Environment Reporting (SOER 1993); and, Agriculture Canada – Center of Land and Biological Resources Research (CLBRR) Ecological Stratification Working Group-ESWG (1995).

The research area is mapped in the Prairie ecozone, which comprises the northern extension of open grasslands in the Great Plains of North America. It is a large and homogeneous ecological unit characterized by relatively little topographic relief with grasslands and limited forest. The southern boundary is the Canada-United States border (49th parallel), arcing from the western edge of Alberta to the eastern edge of Manitoba (ESWG 1995: 92). Due to its location and the Rocky Mountains to the west that impede moisture-bearing winds from the Pacific, the Prairie ecozone has a continental climate: sub-humid to semi-arid with short hot summers, long cold winters, low levels of precipitation, and high evapotranspiration[13]. Two ecoregions dominate the thesis research area. The Moist Mixed Grassland is located in the south half of township 36, ranges 1 and 2, while the Aspen Parkland covers the remainder of the research area. Specifically, the research area is within a transitional climate zone: between a warm summer, continental climate (Dfb) and a semiarid, middle latitude, steppe climate (Bsk).[14] Long, cool summers and severe winters characterize Dfb climate, whereas moisture deficiency characterize Bsk climate. Mean monthly temperatures fall below –3°C in the coolest month and above 10°C in the warmest month. Mean annual precipitation is less than mean annual potential evapotranspiration. Three ecodistricts are part of the two ecoregions. The Neutral Hills are in the Moist Mixed Grasslands, and Edgerton and Provost are in the Aspen Parkland. Common features of these three ecodistricts are: broad slope, predominant landform, regional climate (expressed by vegetation), predominant soil development, and predominant texture of parent material (Pettapiece 1989b). There are four land systems within the thesis research area: the Altario Upland in the Neutral Hills ecodistrict; the Falcon Plain and the Hansman Plain in the Provost ecodistrict; and the Sunken Lake Plain in the Edgerton ecodistrict. All land systems within each ecodistrict have the same general climate for agriculture, but differences in microclimate patterns are recognized. Gleysols and significant eroded soils are present in the research area. Details of the agro-ecological classification are in Appendix A.

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[13] Evapotranspiration is a meteorological process of transferring moisture from the earth to the atmosphere by the evaporation of water and the transpiration from plants.

[14] The Köppen climate classification follows the concept that native vegetation is the best expression of climate, thus selections of climate zone boundaries are by vegetation distribution. It combines average annual and monthly expression of temperatures and precipitation, and the seasonality of precipitation. This classification scheme divides the climate into five main groups (represented by upper case Roman characters) and several types and subtypes (represented by lower case Roman characters). A two or four letter symbol represents each particular climate type.

Although the agro-ecological land classification and the Köppen climate classification schemes are useful tools to reference soils, landforms, and climate of a particular region and locality it does have its drawbacks. Although this classification system is based on long-time averages, it presents a static climate, which is not a useful approach because in the Canadian Plains, weather is both variable and extreme when considered on daily, monthly, annually, and decadal periods. Another drawback is that the boundaries that identify ecozone, ecodistrict, ecoregion, land systems, and climate zones are artificial boundaries created by people. My point is not to say that this particular classification scheme is incorrect or false, only that it is necessary to acknowledge that these boundaries are cultural constructs created to organize and to delimit a biophysical environment where boundaries drawn on a map or entered into a computer software program are meaningless to that environment.

CHAPTER 3

METHODS

> *One of the reasons for this reluctance to give advice about how to do ethnographic research is awareness of the fact that such research cannot be programmed, that its practice is replete with the unexpected, as any reading of the many published research biographies now available will confirm. More than this, all research is a practical activity requiring the exercise of judgment in context; it is not a matter of simply following methodological rules.*
>
> Martyn Hammersley & Paul Atkinson (2002)

> *. . . procedures of small-scale ethnography can be brought to bear on the grand complexities that plague the world . . .*
>
> Clifford Geertz (1983)

The data collected for this thesis employed strategies of ethnographic research: fieldwork, interviews, and participant observation. Fieldwork was the data-collection phase that simply involved leaving my office at the University of Alberta, and going out 'into the field' (Delamont 2004:218). Participation observation involved a combination of observing and 'helping out' as a 'farmhand-in-training'. The ethnographic interview process involved both informal and semi-structured styles, and became my primary technique for collecting the data.

I conducted fieldwork over two separate seasons. Preliminary fieldwork began in the summer of 2003 when I introduced myself, as well as my research to the communities' farmers and ranchers. During this period, I had the opportunity to engage in casual conversation with several community members. Through these conversations, I became familiar with the community's physical environment and social layout. In addition, these conversations with local farmers and ranchers helped me to establish the direction and objectives of my thesis research. After the preliminary fieldwork, I began to reflect on my conversations with local residents and on my personal observations. These reflections helped me to modify my methodology. My second field season was during the summer of 2004. At this time, I conducted sixteen semi-structured interviews with 34 volunteer research participants. In addition to these interviews, I had the opportunity to participate in and to observe some aspects of the community's social life and agricultural activities. I provide a detailed account of the ethnographic research process below.

I base the primary data on informal and semi-structured interviews, and my participation and observations as an "insider" (Jorgensen 1989). Included in the primary data are print photographs and 35mm slides that I took during the two field seasons. In addition, I collected and consulted archival records, Dominion Land Survey reports, county history books, newspaper articles, relevant anthropological, sociological and human geographical journal articles, ethnographies, and government publications and reports. These sources of information provided the supplementary data for this thesis.

This thesis involved human participants; therefore, I was required to submit an ethics statement and a research proposal (Appendix C) to The University of Alberta's Department of Anthropology's Human Research Ethics Advisory Group (EAG) and the Arts, Science and Law Research Ethics Board (ASL REB) for review and approval.[15] Both my ethics statement and my research proposal considered and addressed the eight Guiding Ethical Principles outlined in the *Human Research-University of Alberta Standards for the Protection of Human Research Participants* (General Faculties Council Policy Manual Section 66; 27 September, 1999). The *University of Alberta Standards* comply with the 1988 *Tri-Council Policy Statement for Ethical Conduct for Research Involving Humans.*[16] Throughout my fieldwork I strictly adhered to my obligation as a researcher and conducted my research to the capability that my knowledge permited, and protected the dignity and preserved the well being of my human research participants (GFC Policy Manual-Section 66 1999:2).

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[15] Application for research ethics reviewed and approved by the EAG on May 10th, 2004 (Appendix D) and by the ASL REB on May 25th, 2004 (application number 627) (Appendix E).

[16] 1988 *Tri-Council Policy Statement for Ethical Conduct for Research Involving Humans.* (Accessed: May 10, 2003. Available online:http://www.uofaweb.ualberta.ca/gfcpolicymanual/content.cfm?ID_page=37738)

Process of Ethnographic Research

Preliminary Field Season

I collected preliminary data during a four-week period between May 31st and June 29th of 2003 using ethnographic research strategies of gaining *entrée* (access into the human setting) and acceptance from the members of the community, and developing rapport with potential research participants (Hammersley and Atkinson 1993; Jorgensen 1989; Bernard 1994; Wolcott 2001). The process of gaining *entrée*, "finding a social trail from researcher to informant" (Agar 1996:79), is when the researcher takes her first introductory and exploratory steps into the human setting. My "social trail" was the direct, overt approach. I used this widely accepted approach because it raises few ethical problems, is less difficult than other approaches, such as the covert approach, and it provides for adequate access to social and cultural phenomena (Jorgensen 1989:45). In view of the fact that I was not the first academic researcher in the locality, I discovered that my presence did not create any concern or apprehension among local people. Initial contact with members of the community was neither overly difficult nor awkward. Furthermore, the process of gaining acceptance and developing rapport was a process of gaining and developing a trusting and cooperative relationship between members of the community and me. Given that residents of the Bodo community did not know me, or the purpose of my research these initial steps were fundamental for developing a mutual relationship based on openness, trust, and cooperation.

In many research situations overt access is gained by seeking permission from appropriate authority (board of governors, directors, leaders of the community, etc), or a 'gatekeeper', one or more individuals who have the authority and power either to grant or to refuse *entrée* (Jorgensen 1989:46; Hammersley and Atkinson 2002:63). However, in my situation permission to contact and speak with any member of the community was not required because there was neither a 'higher authority' nor a 'gatekeeper'. Although a 'gatekeeper' was not necessary for *entrée*, I did meet three community members who helped me become familiar with the past and current social layout of their community. Township maps and telephone books were useful in helping me become familiar with family names; however, awareness of kinship ties had to come from speaking with community members. In addition, I was never concerned that members of the community provided their personal bias of the community, or attempted to advance their own interests into my research (Hammersley and Atkinson 2002: 66). At this stage of my research, every conversation was informal, unstructured and unplanned.

As well as knowing the social layout, it was also important to become familiar with the area's physical environment. I used the national topographic survey map (BODO 73D/1: edition 2, 1977) to familiarize myself with the area's hydrological features, roadways, and topography, and the Alberta township map (Municipal District of Provost No. 52, February 2002) to locate titled land, crown land, and residences, including names of landowners. Land in the locality is either privately owned or it is leased grazing land; access to either required the landowner's or leaseholder's permission. In total 60 individuals were directly contacted by telephone. I introduced myself as a University of Alberta student conducting academic research in the community. I explained my association with the Bodo Archaeological Field School, and stated the purpose of my call, which was to ask permission to access their land. Overall, this permission was granted. Access to these lands was helpful because it provided me the means to see a significantly larger portion of the physical environment than I was viewing from the township and rural roads. Not only was I able to view the land, I was also fortunate to have met and talked with several landowners and some members of their family. In addition, I discovered that by the end of the first week in the community it was no longer necessary to identify myself or explain why I was calling. I surmised that my research, as well as my very presence in the community was becoming the newest link in the chain of local gossip.

These initial meetings also provided opportunities to conduct informal interviews. I informed each respondent that his or her identity would remain confidential. Interviews were characterized as ordinary, every day conversations where questioning was casual, free flowing, and unencumbered by extensive preconceptions of what and how topics were discussed (Jorgensen 1989:88). I had a general set of issues related to the aims of my research but my questions varied in each conversation. By raising the same set of issues with different individuals, I was able to gather data about these issues, which helped to discern the viewpoints held by insiders (Jorgensen 1989). In addition, I was able to question individuals about what they considered were matters of interest and importance. Furthermore, questions did not only flow in a one-way direction, i.e. researcher to respondent. I was also questioned about my background, where I live, where was I born, who is my family, why am I studying farmers and drought, what was found at the archaeology field school, what I thought about the archaeological site. Essentially, these were every day, ordinary questions that are asked when strangers meet and are getting to know a little about each other

Gaining *entrée* into the human setting and acceptance by its members, and developing rapport with several individuals were essential first steps in my ethnographic research process. However, as Hammersley and Atkinson (2002:79) note, once the researcher has gained entry and acceptance into the human setting and developed rapport with its residents it is not a guarantee that the researcher will have access to all data within the setting. Constant development and maintenance of the researcher-respondent relationship is necessary to insure data access.

I collected additional qualitative data during this preliminary fieldwork. These data included my field notes, newspaper articles[17], photographs, and maps. In general, I followed Russell Bernard's suggestion of taking field notes (modified to my needs and requirements) and attempted to maintain four types of field notes: jottings, diary, log, and notes (Bernard 1994:181). Field jottings are simply getting down on paper what my memory may not likely remember in an hour much less at the end of the day. I was writing details of my observations of the locality's human activity and what individuals were saying during our informal conversations. This generally consisted of names of family members, when they were born, location of their farm, type of farming operation, how long they lived in the locality, and their observations and opinions about farming and ranching, farm weather, and microclimate in the Bodo area. Bernard (1994) comments that as a researcher, you should not assume your respondent would not like it if you write notes. He states it is important for the researcher to "take the role of researcher immediately" upon arriving at the field site (Bernard 1994:182). Bernard reasons, as a researcher you do not want to become "an inconspicuous participant" but rather "an observer who wants to participate as much as possible" to learn about another's way of life (Bernard 1994:182). As I became more comfortable with my role as an ethnographic researcher, I began to adjust my collection techniques to suit the social setting of my research area.

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[17] Articles came from *The Provost News* and *The Western Producer*. The former is a weekly local newspaper published in the town of Provost, Alberta. (Website: http://www.provostnews.ca). The latter is Canada's largest weekly agriculture newspaper published in Saskatoon, Saskatchewan. Website: http://www.producer.com/

At the conclusion of the four-week period I telephoned the individuals I had met to thank them for taking the time to talk to me about their family history, their farm and their lives in the Bodo locality. I informed them that I was returning to Edmonton and the University of Alberta for the new school year, and that I would be returning the following summer (2004) to continue my research.

Second Field Season

I collected primary thesis data during a three-month period from mid-May to mid-August of 2004 using ethnographic research strategies of semi-structured interviews (Spradley 1979; Bernard 1994; Agar 1996; Wolcott 2001; Hammersley and Atkinson 2002) and participant observation (Spradley 1979; Jorgensen 1989; Bernard 1994; Wolcott 2001). For the initial six weeks, I was working as a teaching assistant for the Bodo Archaeology Field School. I used this time to re-establish contact with several individuals whom I had met from the previous year and to observe local farming and ranching activities. During the final six weeks, I re-initiated my research. I was a participant observer on two separate farms and I conducted semi-structured interviews with 34 research participants. Anthropologists use a wide variety of terms to identity the individuals they interview. These terms include 'informant', which carries negative connotations, or 'interviewee', which places the individual in the context of an object rather than as a subject. I choose 'research participant' because I consider each individual as part of my research team. Their role as research participants in my research mimics my role as participant observer in their farming and ranching life.

I compiled a list of 40 potential research participants based on the preliminary data collected during the first field season. This first step in developing a research sample included individuals who were residing or had resided in the study area. Given the complexity of assessing farmers' and ranchers' experience of agricultural drought and perception of interannual climate variability, I conducted an intensive survey of a limited number of individuals. While extensive questionnaire surveys enable the identification of empirical regularities that generalize a population, the limited number of questions asked in such surveys tends to reduce their explanatory potential relative to intensive, small sample surveys (Hakim 1982). I compiled detailed information through an interview process, in order to have a more complete documentation of farmers' cultural meaning of climate and weather.

Once I identified potential research participants, I contacted them by telephone. I informed each individual about the objectives of my research and the interview process, and its adherence to confidentiality and anonymity. I gave an information package to each potential research participant to read at his or her convenience. The information package included a copy of my research description and consent form (Appendix F), and the interview guide of proposed questions (Appendix G). When I met with a potential research participant, I explained in detail the objectives of my research, the process of the semi-structured interview, the process of achieving and maintaining ethics approval, and the rights of a volunteer research participant. I explained my reasons for choosing them and why I thought their participation would be important to my research (Bernard 1994). I emphasized that they were under no obligation to commit to my research, and this was solely a volunteer position and if they decided not to participate, I would accept their decision. I addressed all questions and concerns at this time. In addition, I informed them where I was staying and how to reach me if they had any further questions and concerns. Finally, I asked if I could call back in three days after they had time to go over the material and make a decision. Out of the 40 individuals I initially asked, 34 agreed to volunteer as research participants while the remaining six individuals either felt they had "nothing to contribute" to my research or they were unavailable to volunteer due to farm and/or ranch commitments and obligations.

I conducted sixteen semi-structured interviews with 34 volunteer research participants. The number of research participants varied with each interview: three interviews with one research participant; nine interviews with two research participants; one interview with three research participants; one interview with four research participants, and two interviews with six research participants. Numbers varied due to social status of the research participant: married, single, or widow/widower. I arranged each interview at the convenience of the research participant, which generally took place in the evenings or in the afternoon, and at their place of residence. At the beginning of the interview, I went over the consent form emphasizing their rights as a volunteer research participant. I gave them a copy of contact information of individuals (Appendix H) they could contact if they had any problems or concerns with my conduct during the interview or my thesis research. I did not receive any complaints or concern about my conduct during my fieldwork. The interviews were either digital or tape-recorded and varied between three to five hours. I tape-recorded the first four interviews and digitally recorded the remaining interviews. I transcribed all sixteen interviews. Generally, each 15 minutes of digital or taped interview took approximately one hour (60 minutes) to transcribe.

The style of semi-structured interviews best served my research needs for two reasons. The first reason was the limited time I had in the field. Although I spent, three months in the study area only six weeks were devoted to conducting the interviews. My fieldwork was short-term, and I did not have the opportunity to interview each volunteer research participant on more than one occasion. The second reason was that this type of interview style is based on the use of a written list of questions and topics that needed to be covered, essentially an "interview guide" (Bernard 1994). The research instrument was a ten-question interview guide, based on the informal interviews conducted in 2003 and designed with both open-ended and fixed format questions. The purpose of this instrument design provided each interview with the "freewheeling quality" of an unstructured interview, which allowed the research participant to express themselves in their own terms and at their own pace (Bernard 1994:209). Moreover, besides following a set of clear questions this instrument design allowed me to maintain discretion to follow any leads that research participants brought up (Bernard 1994).

Richard Emerson et al (1995:114) maintains that for an ethnographer to become sensitive to the local actors' experience and views it is important that she listens to the questions that local actors frequently ask and the answers that they ordinarily give. Emerson et al (1995) point out that using open-ended questions not only allow local actors to use their own language and concepts when responding, but also orient questions to topics that local actors find meaningful and relevant to their everyday concerns. Thus, asking intentionally open-ended questions that make sense to local actors allows people to respond with familiar forms of expression, responses which are socially embedded in a context that makes sense to them and thus reveals their social concepts (Emerson et al 1995).

The questionnaire I designed elicited information on a range of subjects, which included both demographic and family history, as well as specific details about type of farm/ranch operation, land use, and location of farm/ranch lands. Data about factors influencing the operation of the farm and/or ranch included impact of weather and markets, perceptions about economic and environmental risk, concerns about soil moisture and rain/snow, implementation of farm/ranch practices, and observation of farm weather and microclimate. Cultural data included ideology and identity, perception of territoriality, means of communication and information sharing, and curation and transmission of local knowledge and individual experience. The semi-structured interview process provided a broad overview of a research participant in the context of their family, their farm or ranch operation, and their physical environment.

Participant Observation

In addition to these semi-structured interviews, I had the opportunity to participate in and to observe a variety of the locality's social life and agricultural activities. A concern of my research is to explore human-environmental interaction in an agricultural community. Participant observation is an appropriate strategy to address this concern because it focuses on human behaviour and meaning viewed from the insider's perspective, which is observable within the everyday, routine life situation and human settings (Jorgensen 1989:23).

My role as a "participating observer", rather than as an "observing participant" (Bernard 1994:1380), involved a combination of observing the daily activity of farmers in the Bodo locality, and 'helping out' as a 'farmhand-in-training' on two separate, local family farms. I learned how to harrow, but I did not operate the tractor on my own, which, I believe, was more due to the lack of opportunity than not being trusted with expensive farm machinery. I drove a silage truck and I helped stack square hay bales. My research participant taught me how to operate a tractor and how to collect round hay bales. I babysat children while parents were working in the fields. I fed cattle, pigs, and horses. I learned how to organize daily activities around what needs to be done, what should be done, and what can be done – all managed around weather, time, and equipment breakdown. I lived within the community for three months, experienced the same alternating wet/cold, hot/windy summer weather of the western Canadian Prairies as the community members. I observed behaviour and noted conversations. I found myself becoming quite concerned about frost, cold temperatures, and untimely, sporadic rains. I participated in as much rural farm life as I was able. At the end of this field season I felt that my role as a participating observer and ethnographer was at a level where I was able to "write feelingly about the nature of [farm] work: its pains and pleasures, smells and sounds, physical and mental stresses" (Delamont 2004: 218).

Data Analysis

Data analysis for this thesis is qualitative and it takes the primary function of identifying key themes and relationships among these themes (Bernard 1994; Wolcott 2001). To accomplish this, I use discourse analysis to provide a cogent and interpretive approach for structuring, managing, and analyzing qualitative data. For my analysis, I use qualitative data (research participant's narratives) from ten interview transcripts of the sixteen semi-structured interviews conducted between July 21st and August 26th 2004.

Overview of Discourse Analysis

Hajer (1997:44) defines discourse as " . . . a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social relations". Discourse, then is a collection of stories, narratives, scripts, myths, legends, and sagas accounting for events, usually developed chronologically and sequentially, to indicate causality (Bernard 1994). Dryzek (1997:8) describes discourse as "a shared way of apprehending the world". He elaborates that

> . . . embedded in language, [a discourse] enables those who subscribe to it to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgements, and

> contentions that provide the basic terms for analysis, debates, agreements, and disagreements, in the environmental area no less than elsewhere.
> (Dryzek 1997:8)

Burr (1995:163) describes discourse analysis as "an approach to research" with guidelines that recognize the subjective and interpretative nature of this qualitative approach to textual and lingual analysis, rather than as a particular method or technique with specific "how-you-do-it instructions". Burr (1995) notes that although different types of discourse analysis vary in terms of what they are searching for and what particular methodology they are using, the focus of interest is on spoken, signed, and/or written language.

Discourse analysis facilitates the deconstruction of various forms of language to reveal something of the underlying cultural meanings of the people involved. As a study of language-in-use, discourse analysis highlights the importance of terminology and phrase, the specific ways of speaking and understandings, especially its ability to structure the way we think and interact with the world around us (Tonkiss 2004). Discourse analysts examine language as not simply reflecting human reality, as stated by Tonkiss (2004:373), but how language constructs and organizes particular human worldviews in which cultural reality is understood, and cultural meaning is produced and reproduced.

Pursuing cultural meaning is not a straightforward matter of conducting interviews, listening to one's responses, and observing human behaviour. Cultural meanings are not pristine objects waiting discovery, they are interpretive constructions assembled and conveyed by the ethnographer. It is a process, which began with me asking questions and paying attention to what is relevant to my volunteer research participants. However, the key to this process lies in sensitively representing in written text what my research participants consider meaningful and in making their concerns accessible to readers unfamiliar with their cultural world. My task, as ethnographic researcher, is to not only document and convey a research participant's discourse, but also to explain how they use terms in specific situations and how involved volunteers differentially understand and evaluate them.

Guidelines to Data Analysis

As Tonkiss (2004) notes, using whatever adopted tactics to open up the text, the analyst must engage with the data rather than with a textbook approach. Although discourse analysis does not lend itself to standardized frameworks or to strict methodological rules, it does adopt certain core concepts and useful techniques. For my analysis, I draw such concepts and techniques from three references. One is Tonkiss (2004) and the second is Emerson et al (1995). Emerson et al (1995) provide an outline of a systematic approach on synthesizing and analyzing rich qualitative data. Although they focus on guidelines and suggestions for producing, organizing, and transforming field notes, I apply their concepts and techniques to systematically sort and code data, and define themes and categories.

The third reference is a set of questions outlined in an article by Risbey et al (1999). The authors use the fundamentals of general systems theory[18] to document agricultural adaptation to climate change in Australia. Though adaptation is a continuous process, the authors break it down into four components or stages. The first is *signal detection*, which asks what are stakeholders adapting to (signal) and what are they ignoring (noise). The second stage is *evaluation*, which examines how stakeholders interpret a detected signal and how they evaluate foreseeable consequences or impacts. *Decision and response* is the third stage, which asks what adaptation strategies (e.g. risk aversion, benefit-cost analysis) stakeholders employed to deal with the detected signal. The fourth stage is *feedback*, which involves stakeholders monitoring the outcome of their decision to assess whether it was as expected. This general framework is useful to "establish a common vocabulary and to provide a way to think about different parts of the adaptation process" (Risbey et al 1999:139). All responses of participant researchers concerning agricultural adaptability differ slightly and, because this thesis uses an open-ended topical questionnaire, they are difficult to compare. To overcome this difficulty I employed this framework to manage and to code the qualitative data.

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[18] Sytems theory or systemics is an interdisciplinary field (such as biology, economics, management philosophy, physics, organizational theory, sociology) in which complex systems are viewed holistically, as amounting to more than the sum of the parts.

Process of Data Organization and Analysis

My initial step was to re-read interview transcripts, looking closely and systematically at what the participant researcher said. In doing this, I dealt with the interview transcripts as a data set, reviewing, re-experiencing, and re-examining every narrative, while self-consciously seeking to identify themes, patterns, and variations within the records. During this initial process of data analysis, I found it neither necessary nor desirable to use computer-assisted qualitative data analysis software, such as QSR NUD*IST Vivo or Atlas.ti. Focusing on research participants who are *actively*[19] farming and ranching in the community, I choose ten of the sixteen interviews to manually code the data, which I found quite manageable and thus using a software package was not necessary. Moreover, I preferred to manually code the data because it allowed me to remain personally connected to my research participant's discourse.

This first major analytic phase of my thesis involved data coding. This involves a means of opening up avenues of inquiry. The researcher identifies and develops concepts and analytic insights through close examination of and reflection on interview transcripts and observations during participant observing (Tonkiss 2004). Such coding is not fundamentally directed to putting labels on bits and pieces of data so that what 'goes together' can be collected in a single category. Interest is in categories, but less as a way to sort data than as a way to name, distinguish, and identify the conceptual import and significance of particular observations (Emerson et al 1995:151; Tonkiss 2004). Throughout this process, I was asking myself several questions based on Emerson et al (1995): *What are research participants doing? What are they trying to accomplish? How, exactly do they do this? How do research participants talk about, characterize, and understand what is going on? What assumptions are they making?* What Emerson et al (1995) emphasize is that the ethnographer should frame questions that elicit how members see and experience events, what they view as important and significant, and how they describe, classify, analyze, and evaluate their own and others' situations and activities.

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[19] The research participants in this thesis are farmers and ranchers who directly and currently involved in the daily, monthly, and annually management and operations of their farm and ranch.

These questions reflected and advanced several specific concerns linked to my thesis and the interviews. First, these questions give priority to processes rather than to causes or internal psychological "motives" (Emerson et al 1995). Specifically, this priority means asking questions that identify what is occurring and in what order, rather than 'why' questions that ask what is causing or producing some outcomes. In other words, initial coding is a means for developing interpretations or analytic themes rather than causal explanations (Emerson et al 1995). Second, these questions reflected sensitivity to the practical concerns, conditions, and constraints that the participant researchers confront and deal with in their everyday lives and actions. This concern with the practical or the pragmatic requires paying attention to the mundane, ordinary, and taken-for-granted rather than looking only or primarily at the dramatic or exceptional action or event (Emerson et al 1995). Finally, these questions helped to specify the meanings and points of view of the participant researcher.

The next phase involved re-reading, reviewing, and re-examining the coded interviews. I did this by focusing on the three sets of questions outlined in my thesis objectives. I began to explore relationships between coded data and to provide a more coherent examination of themes by linking together a variety of discrete observations. In this thesis, I present research participants' perceptions, events, facts and words accurately as possible; however, data interpretation is my own.

Indented and italicized font, or quotation marks and italicized font reference ethnographic material associated with a semi-structured interview. This is to assist the reader in distinguishing between data analysis and data from the semi-structured interviews. An individual who volunteered as research participant remains anonymous. In this thesis, each research participant is identified as 'Research Participant', or 'RP, and is assigned a unique number. The interview date is included for additional reference. See Appendix I for socio-economic history of the nineteen research participants.

CHAPTER 4

RESULTS

We come and go, but the land is always here. And the people who love it and understand it are the people who own it – for a little while.

Willa Siebert Cather, *O Pioneers!*

. . . there are domains of our experience in which the concepts of quantity . . . are not applicable.

Franz Boas, *The Background of My Early Thinking*

In this chapter, the narratives about research participants' drought-related experiences and weather-related perceptions indicate that the human-environmental interaction is anything but straightforward. Farmers exist in an economic, environmental, political, and social context just like everyone else. This context affects farmers' practices and decision-making strategies. The economic, environmental, and political context is an important consideration when examining why farmers consider the practices and strategies that they do under environmental stress. Although social context is just as important, it is not often the focus of a study on agricultural adaptation to environmental stress in a market-based agro-ecosystem. However, social context can help give insight into farmers' and ranchers' cultural meaning of climate and weather that potentially mediates their adaptability to agricultural drought.

Narratives presented in this chapter focus on household-level beliefs and values that underlie human experiences of, and interaction with agricultural drought in the east-central Alberta community of Bodo. I compile the selected narratives from ten semi-structured interviews conducted in July and August of 2004. In this chapter, I present the narratives in two main sections. In the first section, I consider research participants' definition and description of drought, which is fundamental to the data analysis of this thesis. In the second section, I consider the research participants' locally specific, experienced-based knowledge of weather and climate.

Drought: The Farmer's Definition

Academic literature is laden with debate over the definitions of drought, which are as varied as the discipline defining it and the geographic region it affects. For example, a meteorologist often defines drought as a long-term lack of precipitation, whereas a prolonged period of unusually low surface run-off and low shallow groundwater levels is a concern for the hydrologist. The agronomist defines drought as a period during which soil moisture is insufficient to support crops. A socio-economic definition of drought is an unusual shortage of water that produces an adverse effect on a society and the economy. For farmers and ranchers in the Bodo community of east-central Alberta, "*A drought is pretty self-explanatory. A drought is a drought. Son-of-a-bitch doesn't rain!*"(RP-13, 22 August 2004). Overall, research participants told me that drought involves spring seeding into dry fields, summer storm clouds but no rain, and winter months with no snow; and includes things such as grasshoppers, leafless trees, brown pasture land, bare crop fields, dried-up dugouts, low groundwater, and deficient soil moisture. *"Drought"* in other words is an environmental stress that *"takes a lot out and doesn't put anything back."* (RP-3, 26 July 2004).

To elucidate my research participants' cultural meaning of climate and weather, I asked each individual to define drought and the consequences of prolonged periods of aridity. Although their responses highlight the physical effects of drought, they were all rooted in their own personal experiences and individual observations. For example, for one research participant drought is a significant concern for a farmer; however, he believes that if you are a farmer in this particular area of east-central Alberta then you have to accept that you are always farming in dry conditions.

> *Well, a disaster and we've learned to survive disasters. To define a drought if it doesn't rain, we don't get a crop, but that's part of farming life in this area. This is dry land farm country. It's always been dry. Drought is always a factor; it's the big hang up, but you live with it and accept what little moisture there is.* (RP-1, 21 July 2004)

Another research participant, farming and ranching his entire life in the area and having experienced several periods of both long- and short-term aridity, believes that product (cattle or grain) gives a rancher options to manage through drought.

> *The reason drought is hard to fight is that there are a lot of things that come into play. If I have product, if I can grow wheat, a good crop, bunch of silage, bunch of grain in hand, or cattle then I've got something to fight with, if you don't have product, you can't fight. You have no options. (RP-6, 5 August 2004)*

He continues to explain the difficulty of farming through multi-year droughts. Prolonged periods of dry conditions are requiring greater degrees a farmer's personal and social resolve.

> *If you get up every morning and it's dry, you look up to the sky and the clouds are there but it won't rain. You're asking, 'Why can't it rain?' Droughts are tough to handle, you can take one or two, but year after year, it can mentally really do things to you. It does a lot of things to people. The last 17 years – it gets drier, and drier, and drier every year. Your dugouts are dry and a lot of wells are drying up. It's tough to get up in the morning when it doesn't rain. Drought is really tough.*
> (RP-6, 5 August 2004)

Others view drought as a major factor that is preventing a younger generation of farmers to continue with the family farm or even to begin farming on their own:

> *Well, it's the drought that actually got young people not interested in farming. If it wasn't for that as long as he has product he could feed more cattle, buy more cattle, and make money. But all of sudden dry years hit where he couldn't do that, and young people couldn't so they had to go to off farm jobs. That was more because of the drought.*
> (RP-7, 5 August 2004)

Other research participants expressed their opinions about farmers' adapting their management strategies and decisions, finding the means and ways to make it through one year and into the next year, and the next, but eventually giving up and selling the farm.

> *To a certain extent [farmers adapt] and then they will give up. You see that happening more in the last few years than you use to. People give up. They just can't farm any more and they sell out.* (RP-11, 15 August 2004)

Agricultural drought is common in this research area. Farmers have adapted to the low and infrequent rainfall and/or snowfall in this particular locality; however, as the following research participant explained drought *"continual wears on you"*. In the following narrative, the research participant describes his experience with multi-year droughts. Portrayed in this one particular narrative is a discourse of risk, acceptance, uncertainty, and pride. When I asked him how drought affects him as a farmer, he replied:

> *It has an effect on a lot of areas that you don't even see. People do change their attitude and their outlook on things. When it's raining even if the price for our product is not great and our expenses are high, I might not make any more money, in fact I will probable lose money this year like*

> *I did last year, but if you still grow product and you have something to harvest you feel okay, you know. Well, when you have drought it wears on you, continual wears on you, and it just grinds and grinds away.*
>
> *Even if this year the prices are going to be the shits – if you still have some product and you have a good harvest, a kind of pride of growing something, it's still way better than having a drought. The last five years I must have aged twenty years! I'm serious! It's not been much fun! Just the worst time wondering if you got feed for the cattle, and you got no pasture then you can't grow anything. There is the economic side of it, but there is still also beyond the economic side of it. There's the day-to-day strain and the day-to-day grind. And, you looking at the fucking sky, clouds come over and it wouldn't let go, you just hope for it and hope for it, and it goes by. And, the grasshoppers hatch. It grinds and wears on you, you know.*
>
> *But this year has been a very nice year. I bet it will be good, but there will be a lot of farmers in trouble this fall, don't kid yourself. But it's still been a peaceful, a mind-easing year, you know. Well, we got rain when we needed it. You go out to the pasture, the cattle are lying in grass this high, they are comfortable and they are happy. And, it's just kind of . . . it's peaceful. And, you know what you just feel better! Well, last year when you looked and the grasshoppers are eating the grass and the cattle had nothing to eat. It was sickening, just sickening.*
>
> *This year has been peaceful. You go out and you look at the crops. Even if that crop you know you can't pay the bills with it, you look at, it's a nice crop, you grew it and you've done everything you can and it looks good. It's still a nice feeling. I've looked at my crops more this summer more times than . . . I drive out every day! I do! Every day I drive to look at the cows and look at the crops. This is a happy feeling. Fuck last year, I didn't even want to go out! It makes you sick!*
>
> *It's been god-awful. This year has been good though if we keep going. As long as you have product to work with you can help yourself. But when you tap on the bins and you got nothing, well, you can't help yourself. Like say this year if we get a frost or we get a bunch of rain and we get poor grain, well, you can always feed it to cattle or pigs instead of selling it, or do something. At least you got some options. When you have nothing to work with what are you going to do? You have no grain to work with; you have no cattle. What are you going to do?*
> (RP-13, 22 August 2004)

Hare (1987) defines drought as the failure to receive expected precipitation for a period long enough to hurt. For research participants in this thesis, their definition of drought provides a richness that illuminates the human experience and the human condition within a cultural frame.

Local Experience of Weather

For the research participants – local farmers and ranchers – changes in weather is what matters to them, not changes in climate. Climate is an abstraction compounded from numerous individual and measurable meteorological variables (temperature, air pressure, wind speed, precipitation, humidity, etc), whereas weather is about what it feels like to be warm or cold, soaked in rain or frozen in snow, parched from dryness or drowning in floods. Briefly, climate is recorded and weather is experienced. In this section, I present two examples to illustrate the concept of locally specific, experienced-based knowledge of weather. The first is precipitation, which includes both rainfall and snowfall, and the second is research participants' observation of local weather variability.

Precipitation

> *You can have the worst input and still come up with a crop if you got water and you got sun. You can do everything exactly right and come up with nothing without water and sun.* (RP-3, 26 July 2004)

For my research participants, the significance of precipitation clearly shows in the above excerpt – a farmer's experience is irrelevant without moisture. Even though farmers seed drought resistant wheat and barley and practice soil management, it is precipitation, specifically rain and snow, which is the most important element for farmers and ranchers. In the Bodo locality where grain production and cow-calf operations are under non-irrigation agriculture, farmers and ranchers are dependent on both seasonal rainfall and snowfall for moisture. As one research participant stated simply, *"The one ingredient is moisture. You need moisture. Rain and snow just absolutely affects a farmers world."* (RP-10, 10 August 2004).

Rainfall

Amount, intensity, and timing of rainfall were three attributes mentioned and identified frequently by research participants. Each attribute deals directly with the importance of when and how much rainfall occurs in this particular non-irrigated agro-ecosystem. For example, research participants told me that spring rain is critical before seeding begins, which in the research area is generally during the second week of May and no later than the first week of June. One research participant emphasized that because of the seasonal schedule of farm work and the risk of weather hazards such as an early autumn frost, timely rains are important.

> *There is a certain timeframe when you have to seed. If you seed later then nothing is going to happen because it gets too dry and in the fall, you get into frost. Around here, if you don't seed before the first week of June then forget it! You can wait for rain but only for a limited time. The idea is that you have to seed and hope it rains. Because if you don't seed when it's time to seed then it gets too late, and at the other end it frosts and you don't get a crop. Also, you have to do other things like weed management, fertilize, and things like that. There are proper times to do them. There is a season for all things. There really is.* (RP-5, 4 August 2004)

Research participants also remarked that due to variable and limited rainfall throughout the research area it is essential for rain to occur when both plants and livestock are able to get the best use of this precipitation. For example, spring rain is needed in April and May for seed germination and summer rain in June for crop growth. Furthermore, research participants frequently commented that their area does well with only *"six inches of rain"*. In other agricultural areas in Alberta, such as the 'Highway 2 corridor' (located longitudinal between the urban centres of Calgary and Edmonton), the Camrose region southeast of Edmonton, and the Peace River country in north-central Alberta, ten to twelve inches, or more, of rain is necessary. Research participants explained that *"six inches of rain at the right time"* is a sufficient amount of rainfall for crop production in their particular area. The following excerpt illustrates this observation:

> *Our best time for rain is April and May; it can germinate and get started with a water base for the plant to carry through. June is supposed to be our wet month, but if there is no moisture you don't have anything to start the seedlings then you don't have anything to get them going. If you get your first rain in June, then they start but it's actually too late. A lot of that seed lies in the ground and doesn't germinate. If we get rain at the right periods of time we can grow a crop with less than six inches of rain. You can get a bumper crop with less than six inches.* (RP-3, 26 July 2004)

In addition, research participants use the concept of *"deep soil moisture"* to explain why the research area does not need twelve inches of rain. As one research participant explained, *"Our soil moisture is very deep, so six inches of rain will go a long way"* (RP-11, 15 August 2004). In addition, research participants told me that soil moisture[20] in the research area is approximately three to four feet and even five feet in depth depending where you are standing. A report on the groundwater resources in the Municipal District of Provost supports these comments about *"deep soil moisture"*. This report indicates a "significant source of shallow sand and gravel deposits are present within one metre of the ground surface" (Hydrogeological Consultants Ltd. 1998:14). These sand and gravel deposits are significant because they provide a pathway for snow and rain to move downward into the groundwater (Hydrolgeological Consultants Ltd. 1998). In a semi-arid agro-ecosystem where rainfall is variable and limited, deep soil moisture is a valuable asset.

Precipitation in the research area is also widely distributed in not only amount and timing but also location. Each research participant commented that variability and amount of precipitation is not only year-to-year and locality-to-locality, but also farm-to-farm. In the following excerpt, one research participant not only illustrates this variability between localities and farms, but also he states that such variability is expected. For example, Esther, a hamlet located approximately 40 kilometres southwest of Bodo, is consider by research participants to be even more arid than the research area, whereas the farming and ranching area north of Provost, which receives more rain, is seen as less arid.

> *It's always drier in that Esther country. And, north of Provost, they always get more rain than we do. Right where we are sitting, we get rain. This year prime example, Bodo gets half an inch, we get an inch, and two miles down the road gets half an inch. A stretch here, then a farm at K.H's, and through the hills all the pastures over there it rains and rains. It's always streaky. It's been like that for as long as I can remember. There is a path here. There is a path at K.H.'s and you go six miles down the road there is another path.* (RP-10, 10 August 2004)

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[20] Soil moisture is the main source of natural water resources for agriculture. It affects the vertical flow of energy and moisture to vegetation, and the horizontal flow of moisture that results in runoff. Furthermore, soil moisture, along with snow cover, is the most important component of meteorological memory for the climate system over the land (Delwork and Manabe 1988).

Research participants told me that they use rain gauges (small, funnel-shaped containers) to measure rainfall. One research participant remarked that *"getting a rain gauge from the grain elevator is more valuable than getting a calendar from the bank"* (RP-1, 21 July 2004). Most farmers use rain gauges to collect rainfall amount and some will, from time to time, record the amount on calendars, in journals, or notebooks that may or may not be disposed of in one or two years. Although useful, research participants rarely mentioned rain gauges when they talked about how much, or where, rain did or did not fall. However, the ethnographic narratives in this thesis illustrate that measuring and recording rainfall is in the human stories of each research participant. These stories express perception of weather conditions that are usually associated with specific locations, as mentioned in the above excerpt, or with a particular seasonal activity, such as during spring seeding or autumn harvest. Thus, examination of these stories, rather than rain gauges, could provide insights into how farmers curate and transmit information about climate variability, environmental stress, and possible adaptive behaviour.

Another aspect of precipitation that research participants talked about was general rain. General rains are a steady rain shower that was an annual, even a *"guaranteed"*, weather event, lasting for several days and covering a wide portion of the area, and on the 1st of July 2004, Bodo and the surrounding region received such a rain. The following excerpts illustrate the importance that such expected weather events are to the research participants. Although research participants expressed relief and hope that these general rains can bring to the area, they also discussed that just like winter snowfall, these much *'looked forwarded to rains"* are an increasingly uncommon event.

> *Well, July 1st we had three, four days of general rains that has been the first general rain we had in five years. A general rain is where everyone got some, and they have been fewer and fewer between. More often, you would get a shower here and two miles down the road there was nothing.*
> (RP-5, 4 August 2004)
>
> *The whole country gets it. Just steady rain. We had one this year, July 1st, pretty much a general rain. But it's not as common as it use to be.*
> (RP-10, 10 August 2004)
>
> *Always got the general rains! Oh, that was nice! It would sit in and rain for three days. If the wind blew out of the southwest then it would rain for three days, slow and steady. Slow for three days straight. If the winds*

> *came out of the southwest, you could be guaranteed a general rain. And, this year we had it once, first time in five years since we had a general rain.* (RP-13, 22 August 2004)

In this marginal physical environment of east-central Alberta, it only takes a few days of consistent rainfall for farmers to speak of a 'wet season' or a 'good year'. Consistent rainfall at the right time and covering an extensive area tends to generate a collective sense of well-being and optimism.

Snowfall

Even though each research participant repeatedly discussed the importance of snow, it was interesting to hear them state that snowfall, not rainfall, is the single most significant weather event in their locality. The following three narratives illustrate the importance of snow for soil moisture and the consequences for the lack of snowfall and rainfall. Research Participant-11 opined that low snowfall and rainfall are contributing factors to the loss of soil moisture in the research area. He jokes about a year that rainfall was so infrequent; farmers did not even know that it rained at all when it did. Although he made his comment light-heartedly, he is serious in his opinion that regardless of the amount of snow and rain the research area may receive it would never be enough to replenish what soil moisture has already been lost.

> *A lot less snow nowadays and during the dry years we had a lot less rain too. We've hardly had any rain some years. There was one year here we would get the odd tenth* [of an inch], *but that was a fault. If you didn't get up in time to see it rain you would have missed it! It was so dry that one-tenth had no affect on anything. A tenth would be nothing because there is no moisture in the soil. Now we are still dry. We have deep soil moisture, but we don't have that sub-moisture* [local concept for deep soil moisture] *now. It will take years to get that sub-moisture back. One year will not do it. It has to keep penetrating into the soil. Rain is valuable but snow more so because of runoff for water in the dugouts and sloughs, and for sub-moisture.* (RP-11, 15 August 2004)

Research Participant-12 opined that snow is more important than rain because the research area receives low seasonal rainfall. She also believes that low snowfall is contributing to low soil moisture levels in the research area.

> *When we had an awful lot of snow we were never lacking for sub-moisture. We would need a lot of snow because we know that this area*

> *never gets extreme rains. We get enough [rain] to survive and maybe some years a little more than others, but snow was a big thing that we relied on.* (RP-12, 15 August 2004)

For Research Participant-7 snowfall is important not only to replenish soil moisture but also to fill dugouts with water. As he explains that during those years when rainfall was less than expected in the research area, a farmer could rely on winter snowfall to fill dugouts for cattle and to provide moisture for alfalfa fields. He concludes by stating that he also believes that soil moisture in the research area is less due to low snowfall.

> *We always had lots of snow in the winter, so even if it was dry in the summer the sloughs were full and you had that reserve of hay at least when they dried down. There was the sub-moisture, but lately we haven't had that.* (RP-7, 5 August 2001)

Local Weather Variability

Research participants make their livelihood by navigating the intricate rhythms and random states of weather. Farmers use direct observation to forecast short-term, local weather phenomena and personal experience to identify general local weather trends. This local and generational knowledge of folk meteorology includes weather folklore, weather proverbs, and weather sayings. For research participants, their collective cultural knowledge of folk meteorology resides in weather phenomenon and trends being *"reliable"*, *"readable"*, and *"true.* Although uncertain and variable weather conditions have always been part of the farming and ranching scenario in the research area, the following narratives illustrate that research participants perceive extreme local weather variability as the cause for unrecognizable, unreadable, and untrue weather phenomenon.

"Reading Weather"

While each research participant acknowledges that *"weather can and does change from one day to the next"* and *"every year is different"*, they also discussed weather events as *"predictable and dependable"*. One research participant describes how in years past farmers were able to read the signs of nature *"just like a book"* (RP-13, 22 August 2004). This research participant also states that *"those old signs are not as reliable as* *they once were"* and as such weather patterns are not recognizable, they are not predictable and dependable. Such signs are animals crowding into a corner of a pasture would indicate an approaching storm, or the turning over of foliage would indicate rain. In the following narrative, the research participant describes what he perceives as a greater frequency of weather event variability within and between seasons. He believes that "extreme" weather events are making it difficult for farmers to *"read the weather"*.

> *Generally, over the last ten years I would say that the weather has been more erratic than ever. Like from one extreme to the next. I would say that we are more now in a freak weather pattern it seems. We go from one extreme to the next. All of a sudden, you get a tornado, a hailstorm, and a violent storm. Then you will go three months without a drop of water. At one time, it was guaranteed that if the wind blew out of the southwest it would rain. It would rain and it would rain and never quit. It used to be more consistent. It was the same way with the heat. Like last summer we had heat that was unbearable, this summer not. Last summer it was 35 plus for day after day after day, just extreme weather. We used to not get extreme weather it was more consistent. You would get warm days that were 25 to 30, and then you would get a rainy period.*
>
> *You could chart your weather pattern. It was consistent. Every week you would get an inch of rain then in between it would be warm and then come the 1st of November it would snow, guaranteed. If you still have bales out in the field or you still had work to do you were screwed. By the 1st of November, it was winter like clockwork, it would snow, by Christmas you had three feet of snow, and by February, you had five feet of snow. It was just consistent, every year, but now the weather is as erratic as hell! Nowadays, in winter you might go a month without a flake of snow.*
>
> *I think the weather is gone erratic. It's too unpredictable. Weather was predictable and dependable, but now it's erratic as hell it seems. I think the weather now is more erratic and unpredictable then what it was. At one time, my dad didn't need a weather forecast. He just knew. Just knew from nature's signs. He looked at the animals and the plants. 'Oh yeah, it's going to rain in a couple of days' and boom in a couple of days it would rain! Or, he could tell by the way the wind was blowing. He could just read it just like a book. Like a book and now you can't. People do not know how to read the weather anymore. But I don't think that those old signs are as reliable as they once were. But people don't know them patterns like they did. Like them old guys just knew them. They knew that it was going to rain.* (RP-13, 22 August 2004)

"True Weather"

Each research participant relies heavily on their personal observation and experience of weather events. Most commonly, they collect, manage, and store their weather data through local knowledge. Research participants believe that they have an understanding of their local weather and climate that comes from their long-term, daily and seasonal connection to their physical environment. They perceive an increase of irregular weather patterns in their locality. As RP-13 stated in the above narrative contemporary farmers cannot read these signs since nature is not providing recognizable ones – weather, as one research participant expressed, is no longer true (RP-14, 22 August 2004). She explained, "*It is just a matter of recognizing them [signs]. Nature will give you signs, but the weather doesn't follow a pattern anymore. Weather is not true as it once was. Those patterns use to work but they don't anymore.*" (RP-14, 22 August 2004). Another research participant made similar comments, "*As far as I'm concerned our environment has changed. It doesn't have its true course. The weather is not even close to what it used to be. You could rely on certain things but not anymore.*" (RP-11, 15 August 2004).

CHAPTER 5

DISCUSSION

> *We are dealing with interplay between two very different fluids – atmosphere and ocean – in the boundless dimensions of time and space. Neither medium has a 'normal' state, and abnormality in one causes abnormality in the other. Weather is always abnormal. Events such as El Niños have no definite starting point and no end – it's a matter of where you break into the scene, and where you leave it. Perhaps the only thing more complex is human behaviour itself.*
>
> Jerome Namais, *National Geographic* (February 1984)

> *What we call the landscape is generally considered to be something "out there." But, while some aspects of the landscape are clearly external to both our bodies and our minds, what each of us actually experience is selected, shaped, and coloured by what we know.*
>
> Barrie Greenbie, *Spaces*

Climate and weather are means of reference to meteorological variables (precipitation, temperature, humidity, etc) that characterize the general conditions of the atmosphere over a period of time at any one locality or region of the Earth's surface. Through culture, climate and weather are also particular means of expressing cultural values, beliefs, and practices. Anthropologists, such as Sarah Strauss and Benjamin Orlove (2002), Carla Roncoli and John Magistro (2000), and Roderick McIntosh, Joseph Tainter, and Susan Keech McIntosh (2001), who study human relationships with climate and weather, suggest that not only 'talking about the weather' but also experiencing weather is a ubiquitous human behaviour. Humans' complex forms of collective cultural life and communication influence the way climate and weather affects them. This cultural collective creates, manages, and maintains both forms of human adaptability and social vulnerability to environmental phenomenon of climate variability. Such a highly developed cognitive capability allows humans to recall past environmental stress and to anticipate future stress within a particular landscape. Drawing on this temporal and geographical awareness, the farmers and ranchers who participated in my thesis research shared with me their experiences with agricultural drought and perceptions of interannual climate variability. Research participants talked about recent agricultural drought, remembered arid conditions months ago, anticipated future arid seasons, and discussed drought far in the past. These multiple times within a particular locality form an elemental aspect of human relationships and cultural practices that give climate and weather its meaning.

In the following discussion, I begin by discussing the application of historical ecology, a landscape-based approach, in order to conceptualize climate as a socially/culturally-constructed place. Following this is a discussion of how localism and generational experience have informed my research participants' cultural meaning of climate and weather that mediates their adaptability to agricultural drought.

Historical Ecology: Meteorological Landscape

Historical ecologists examine landscapes to document how humans and the biophysical environment mutually influence each other over time and within space. Historical ecology offers both conceptual and practical tools for documenting a coherent, place-sensitive narrative of human-environmental interaction (Crumley 1994; Balée 1998). Historical ecology addresses the interaction between human society and the biophysical environment in two important ways. The first is that it views this interaction as a dialogue that unites the dichotomies of nature versus culture (Ingerson 1994; Balée 1998; Biersack 1999). Secondly, historical ecology is concerned with multiple spatiotemporal interactions such as human-local, human-environmental, human-regional, and human-biosphere (Crumley 1994; Balée 1998). Moreover, historical ecology focuses on the production of place and the activities, technologies, informing ideas and values, and social relations of that production (Giddens 1983, cited in Biersack 1999:9). As a result, historical ecological studies have a diachronic and holistic dimension that affirms the biophysical environment is not independent from human activity. Thus, the task of historical ecology is to study human-environmental interaction in a particular landscape over time, influenced as it will be by local climatic conditions, large scale climate change, environmental stress, local human actions, and the larger human systems that impinge on the local group and its activities. Conceptually, historical ecology focuses on landscape, biosphere, human-environmental dialectics, and region; however, landscape is its paramount concept (Balée 1998:1). It views landscapes historically, as well as ecologically. Historical ecology attempts to study landscapes as an artefact of human activity (Balée 1998). Carole Crumley (1994:7) defines landscapes as "the material manifestation of the relation between humans and the environment" that represents a means of introducing geographical space into anthropological analysis, where it can serve as a "laboratory of past human choice and response in which the effects of environmental change can be palpably understood" (Crumley 1994:7).

So, how do these definitions of landscape relate to Jennings' (2002) idea of conceptualizing climate and weather as a culturally constructed place? By taking a landscape-based approach, one recognizes that climate, just like landscape, is also multifaceted, complex, and saturated with cultural meaning. Both climate and weather meditate people's experience of environmental stress and perception of climate variability. Additionally, by taking the landscape-based approach, this thesis demonstrates that these connections are not readily amenable to replicable measurement, quantification, and generalizations across populations and between localities. In other words, cultural meaning of climate and weather is place and culture specific. Furthermore, this landscape-based approach is relevant to the anthropology of climate and weather; because it provides the means for merging scientifically derived conclusions about the structure and function of a particular environmental stress with the long-term, local knowledge of climate and weather that individual members of a culture have acquired within their particular community.

Cultural Meaning of Climate and Weather

Ethnographic narratives can provide insight to the meaning that human agents create in the conduct of social and cultural life, upon which they build their understanding of their world, and through which they seek to act upon that world. These narratives, in other words, express the nature of human experience and condition, the structure of perceptions, the recognition of interests, the development of a network of relationships, and the maintenance of frameworks for collective action. As demonstrated in the results chapter, research participants use narratives to express their ecological, economic, and social experiences with agricultural drought, and their perceptions of interannual climate variability within the research study area.

Through qualitative analysis of these narratives, I identify spatial and temporal themes in research participants' cultural meaning of climate and weather. I discuss two themes in this section. The first theme is spatial, which illustrates research participants' shared local experience and knowledge of agricultural drought. The second theme is temporal, which examines the varied experience and perception of agricultural drought between generations. Embedded in these themes are discourses of risk, uncertainty, and acceptance. These themes play prominent roles in each research participant's cultural meaning of climate and weather. More often than not, local and generational experiences and observations concerning agricultural drought were interwoven into narratives relating to the performance of particular tasks, such as seeding, haying, harvesting, or calving, or to the retelling of individual life histories, such as memories of childhood, stories of coping with environmental stress and/or non-environmental adversity, and the like. As such, these human experiences and observations form part of each research participant's ongoing cultural meaning of climate and weather that informs their adaptability to agricultural drought and perception of interannual climate variability.

Drought experience: Localism

For the purpose of this thesis, local knowledge is acknowledged as "not something that is handed down as a set of customary prescriptions or formulae; rather it grows through a lifetime's experience of living in a place and moving in its environs" (Ingold and Kurttila 2000: 187). In other words, local knowledge involves a mutual and practical interaction between people and their biophysical environment that is both temporally and spatially specific. One research participant, who has lived and farmed his entire life in the Bodo area, illustrates this long-term and daily connection with his local environment in the following excerpt.

> *Over the years, you just know your land and what it will or will not grow. You just know your own land, and even others' land very well because it has been talked about to death. I know the history of this area and these lands back three generations because I've been here. I know what was grown on a section of land for the last ten years. I can tell you what that guy's field grew and what it's done, and what that guy's field grew. It's just from being around.* (RP-13, 15 August 2004)

The following narrative not only portrays the research participant's sense of pride of their local knowledge but also her attitude to an outsider's unsolicited opinion about her and her husband's on-farm practices in a dryland agro-ecosystem. She states this individual's opinion does not carry any approval with either her, or her husband, especially since it was expressed in an arrogant and ignorant manner.

> *A few years ago, we were at a farm seminar of some kind. Some guy from Lacombe or Rimbey proceeded to tell us that if we farmed properly that we wouldn't be in such rough shape. K. stood up and walked away. I said 'If we traded places with you, you would be broke in no time flat because you wouldn't know how to farm here.' He stuttered and stammered. He didn't know what to say. I said, 'You guys sitting here along Highway 2 with all this lush green grass you wouldn't have a clue how to survive out in this country'. He didn't believe me and I didn't care. I got up and walked away too.* (RP-9, 8 August 2004)

Overall, each research participant believes they not only have experience and knowledge, but they also believe they have the fortitude to deal with drought conditions. For example, as one research participant explained, *"Some areas have never suffered for drought. When you have had it off and on for so many years you learn how to cope with it"* (RP-12, 15 August 2004). This pride of relying on your experience in order to adapt under extreme environmental stress is evident in each interview. The following three narratives provide exemplary illustrations of this pride in local knowledge.

In the first narrative, the research participant talks about the 1999 – 2004 drought[21] and he discusses why farmers who had never experienced drought had difficulty adjusting and dealing with such dry conditions. He explained to me that *"planning ahead"* is the hallmark of a farmer who has drought experience. What's more, he believes, in the Bodo area, farmers are prepared *"psychologically"* to cope and to bear through to the next year because of their experience with multi-year droughts.

> *The whole west was dry. Some of those areas couldn't cope with it because they didn't know how to, they went through weather like we have but not dry years. We know how to handle it. We plan ahead a little bit. They didn't know what to do. They got caught, and had to sell their cattle. There were areas that have been dry before but not areas around Camrose or west of Edmonton. Those guys didn't know what to do. They weren't even that dry yet. I said," I should load up a bunch of you guys and take you to Bodo and show you what dry is!" It got too dry for them. This area has always been a bit of a drier area so you kind of look out for it. You look ahead. I just don't make feed for this winter, I make feed for next*

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[21] Identified as the most extensive multi-year drought that Canada has experienced to date, the 1999-2004 drought extended farther north, west, and east than the droughts of 1929-1937 and 1983-1988. 1958, 1961, and 1967 recorded single year droughts.

> *winter also. You put feed ahead. You don't put up feed for just one year not around here.*
>
> *I think that psychologically we are better prepared for drought here even though we don't have anything. We're kind of used to it than where they never get it. It mentally affects them more. It still bothers you, but you have gone through it so many times that you are used to it. It's always hard but it's kind of born into you, I don't know how to put it. You know that it can happen but you keep going on.* (RP-11, 15 August 2004)

In the second narrative, the research participant expresses similar belief to those of the RP-11. Moreover, I asked him to describe his ranching practices and decision-making he uses when dealing with aridity during prolonged periods of drought. He told me that ranchers have no other choice; they must adapt their practices and strategies to the semi-arid conditions. In the research area, he explained that agricultural drought is neither a recent nor a new environmental stress. Ranchers in the research area already know what they must do in order to adapt to drought. He compared farmers from the Peace country to farmers in the Bodo area. The Peace country is located in north central Alberta and is considered as one of the best agricultural areas in the province. In this area lack of moisture is never a concern even when multi-year droughts do occur, thus in this research participant's opinion Peace country farmers neither have the knowledge nor the experience to adapt to drought.

> *We don't have to adapt. We're in it! We've adapted. You don't have a choice! You know what I mean. It's not a yes or no, true or false thing. The thing of it, as I see it, is that we've not been in a drought for just one year. It's not like, 'Holy shit what are we doing?' We've been in nearly 20 years of drought! There's no adapting for us. People who are in the Peace Country, those guys don't know how to adapt – if you go up there, they have enough feed for their cows. For us we have enough feed for next year because we have to. We don't know if we're going to get feed next year or not. And, for those guys it's a guarantee. Well, lately it hasn't been a guarantee for them and they don't know how to adapt.* (RP-10, 10 August 2004)

In the third narrative, this research participant opined that along with the land, people become accustomed to the particular conditions in a locality. This research participant accepts that he is farming in a semi-arid agro-ecosystem. He has adjusted his on-farm decision-making strategies, his equipment, and his farming techniques to the unique weather and climate conditions in the research area. He explains that, as a farmer, he has adapted to, and has acquired knowledge of, drought conditions just as the land and the plants have.

> *There's an adaptation that takes place. Whether it's with people or the land or both, your land kind of gets accustomed to drought, or accustomed to the rain that you get. The plants do. And, they* [plants south of Bodo area] *are accustomed to four inches of rain a year, here they are accustomed to six, and north of here, they get accustomed to ten. They can grow on less rain than we can the same amount of bushels or the same amount of hay or the same amount of whatever. Their plants are adapted to it, their land is adapted to it, and I guess, the same way that people adapt to it, same thing.* (RP-13, 22 August 2004)

Another research participant reiterates this pride of coping with, and making it through multi-year droughts. During this later interview, I asked if he thought a farmer from a non-dryland agricultural region, such as the Edson area or the Peace country would be able to farm in a semi-arid agro-ecosystem like Bodo. *"It would be pretty tough"*, was his reply. He continued to explain by recalling a personal event that involved him buying hay bales from the Camrose area. RP-18 related the astonishment of the Camrose farmer (who had hauled the bales) that RP-18 was still farming and making it work in *"a desert land"*.

> *I was out of feed different years. It cost me eight dollars a bale for the straw and eighteen dollars to truck it here; they brought it in from Camrose. And, he* [farmer from Camrose] *said, 'I don't know how you guys can do it.' I said, 'We do it quite a few years in a row where we don't get any rain.' When he asked how many bushels an acre*[22] *we were growing compared to what he was getting he couldn't believe that we were still surviving out here.* (RP-18, 26 August 2004)

Drought experience: Generational

In my analysis of each interview, I note research participants expressed that the weather was not only different when their parents and grandparents were farming and ranching, but also in their own earlier years of farming and ranching. In this section, I borrow Strauss and Orlove's (2003) description of 'generation' as a time interval to characterize a particular aspect of human experience with environmental stress and perception of weather and climate variability. Strauss and Orlove (2003) suggest that the temporal unit of 'generations' corresponds to what atmospheric scientists call climate variability and climate change. They state that numerous meteorological variables (temperature, precipitation, humidity, and the like) on local, regional, and global scales shift through cycles that are decades or centuries in length, or changes on even longer time scales. Moreover, they note that this time interval is linked with particular forms of language and communication that include formal narratives of folktales, use of place names to record weather events, and public discussion of changing climate. The editors call this interval 'generations' rather than 'decades' to emphasize the "connection between individual experience and collective conservation" (Strauss and Orlove 2003:9).

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[22] Research participants told me that when seeding and growing conditions are optimal 35 bushels to 40 bushels per acre is average for the research area. However, during those periods of long-term drought it has decreased to 18 – 25 bushels/acre. During the later years of the 1999-2004 drought, farmers were harvesting as few as three bushels/acre.

In each narrative, research participants, regardless of age and experience, express a discourse of awareness and acceptance of arid conditions in the research area. In the following narrative, the research participant, who has lived and farmed in this area for 70 years, summarizes these over-riding themes.

> *We can't change the drought system. We can't change the amount of rain we get. They can tell me that it's going to be dry next year but I am going to farm next year anyway. Because I don't accept for one minute that they can predict that it's going to be dry. Maybe it will be raining like crazy and maybe it will be dry. We just had five or six inches of rain, which is more than we've had at one time in ten years. We usually get a half-inch or 3/4 of an inch of rain. You never give up because you don't have any choice. You cannot change the weather. If you want to change the weather then move to a different area.*
>
> *This is a dry area. This is dryland farming. You have to kind of gamble on the weather but we just accept it as a fact of life. There is nothing that you can do about it. That's for sure. We just accept that this is dry country. We're willing to take the chance. It's a tough life, but you accept it the way it is. Farming is a lifetime challenge. If you want to be a farmer accept the dry with the rain then be a farmer. If you want a 50-bushel crop every year, don't be a farmer. Well, not in our area anyway!*
> (RP-1, 21 July 2004)

In another narrative, the research participant, who has lived and farmed in the area for 60 years, explained, seeding is what a farmer does whether there is spring moisture or not, she said, *"It's a farmer's philosophy: you seed!"* (RP-5, 4 August 2004). Research Participant-1, who has lived and farmed in the area for 70 years, supports RP-5 belief. He told me *"You always seed. You seed and you hope for rain"* (RP-1, 21 July 2004).

However, this particular farming strategy is not shared by those research participants who are in their thirties and early forties, those who began full-time farming in the 1980s or later. Although research participants from a younger generation share the same sense of pride and acceptance as their older generation, and believes in their ability to cope with and adapt to agricultural drought, a much stronger discourse of uncertainty can be discerned in the narratives of the younger generation than older. The following narratives portray the later generations' experience with agricultural drought.

In this narrative, the research participant believes that as a farmer experiencing multi-year drought in the research area he has a closer connection with his grandfather, who farmed in the same area but during the 1930s, than he does with his father. Although drought events (one or two years) did occur in the 1960s and 1970s, the research participant explained that farmers could still expect a crop during harvest season.

> *The 30s was one generation of people who went through the drought. There is none of them left, very few, the odd person. Now we are going through this other drought. There was a generation of people, like my dad and uncle, who went through a period but they did not know what drought was. It was automatic in the 60s and the 70s they seeded crops, they combined, and they made money. It was automatic, did it like clockwork. Didn't know what drought or any of that shit was. And, now we are seeing that* [multi-year droughts] *again, but there is nobody that has experienced it is left. The 30s them people like that are gone. My grandfather went through what we are going through now. They are not here anymore.* (RP-13, 22 August 2004)

Although research participants of an older generation maintain a practice of spring seeding regardless if the land has received rain or not, it is not a rule that the younger generation of research participants are following. In the next narrative, the research participant, who is in his early 30s and has been involved in the family ranch for most of his entire life, explained his *"pretty simple rule"*: if there is no spring rain before the seeding deadline he will not seed.

> *Dad* [living and ranching for 55 years], *he still seeds. I made a rule two, three years ago that if I don't have any moisture then I wouldn't seed. What's the use? What's the use to run over everything? What's been happening is that you seed, it's going to rain and then it doesn't, then all a sudden it might come up, it's knocked over by hail, and it's done. Then you have to re-seed. I wasn't going to seed; then the rain started coming.*

> *Okay, go out and seed. There was a time frame where you seeded and you did all right. Now it's absolutely bone, dirt dry. It's different from year to year. One year could be hot and windy, and the next it's not. I just made a rule that if it's not wet I wouldn't seed because all I end up doing is reseeding, and I don't need the practice doing it. It's a pretty simple rule.* (RP-10, 10 August 2004)

In the following narrative, the research participant explains that storing product (hay, green feed, straw, silage) for two or more years is now a necessary coping strategy to manage through multi-year droughts. He contrasts his strategies to those of his father's generation. He explains that storing feed for longer than one year was not necessary when his father was farming during the 1960s and 1970s because farmers could manage short-term (one or two year) droughts; however, for this research participant and farmers of his generation, this is no longer possible when multi-year droughts are more frequent and intense. During the past twenty years, there have been two periods of five consecutive drought crises: 1983 – 1988 and 1999 – 2004.

> *Well, the first time you go through a drought, the first couple of years you think short-term, it will turn around. And, after a while it doesn't. Sure then there are changes. Like we said you seed earlier, the feed thing. This year is the year that we will have straw and there is lots of it and lots of hay to put up. Guys are putting up feed that is coming out of their ears! And, you know what they are thinking? Next year we are not going to get anything! They're putting up at least two years of feed. Silage, green feed, hay, straw, anything that can get thrown together. You are going to see it this year because we got good growth. We got a lot of product here. You are going to see bale stacks in everyone's yard. More than anyone will ever need. And, years back, like when dad was raising cattle he would put what feed he would need for the year, maybe a little bit extra, just a little bit. Just in case. All it was in case the spring was long and you couldn't get cattle out to pasture, but never too much extra.*
>
> *You are going to see guys this year put up feed for two years. I'm going to do it because I'm to the point that I don't believe that we can ever grow anything until I see it. We grew something this year. Well, I figure that we aren't going to get nothing next year. I have seen so many nothings that I just believe that it can't turn around. So, I got the chance this year to put up feed. I'm going to put up feed for two years and if I can get enough I will put up for three years, because I don't know when I will get the next chance. So, if I got a chance to put up feed I'm going to put it up. 'Cause next year – I don't believe that I will get anything. However, much feed I can put up then I will put up. I will put up for two, three years – whatever I can get my hands on. And, if next year is a good year then*

> *good! Then I'm good. In them days, [parent's generation] they just put up whatever they needed. They never put up extra. They never worried. They always grew something. It was automatic. Automatic! You went in spring and seeded and in fall, you harvested.* (RP-13, 22 August 2004)

CHAPTER 6

CONCLUSION

In these matters, the only certainty is that nothing is certain.

Pliny the Elder (23 AD – 79 AD*)*

Things do not change; we change.

Henry David Thoreau (1817 – 1862)

Half the world is composed of people who have something to say and can't,
and the other half who have nothing to say and keep on saying it.

Robert Frost (1874 – 1963)

Particular cultural forms shape perception, recall, and anticipation of environmental stress, such as agricultural drought. In the concrete setting of Bodo, Alberta, research participants experience, discuss, and interpret agricultural drought that are dependent not only on the physical characteristics of this environmental event, but also on the human experience and human condition. This is all within a cultural framework, that separates climate and weather into current, recent, and distant periods, and into local, regional, and even global space. In other words, an agricultural drought consists of physical consequences (dry, brittle and saline soil) and a symbolic phenomenon (the human capacity to form attachments with a particular place) that conveys multiple cultural meanings bearing on the research participants' values, beliefs, and decision-making.

Purely physical change is an environmental factor, such as those associated with interannual climate variability, and should be distinguished from environmental stress, which results from the influence of such variability on societies. This thesis demonstrated that environmental stress, such as agricultural drought, is a cultural construct, meaning that a society declares it a stress, and that the nature of the stress cannot be divorced from the specific society and culture that realized it. Thus, any proposal to adapt to or mitigate agricultural drought must take account of the historical and contemporary context, the local interactions between the physical environment and society, the cultural meaning of climate and weather, and not only existing land use, on-farm management systems, and government agricultural policies.

This thesis attested to the importance of climate and weather as a site for anthropological investigation of the interactions between humans and their biophysical environment. In particular, it illustrates how cultural meaning of climate and weather discloses the complexity of human-environmental interactions. People experience their environment in a variety of different contexts and rely pragmatically on different sets of ideas, beliefs, and values that need not be consistent. For that reason we should not separate people's social and cultural elements from their use in interactions with the physical environment (Croll and Parkin 1992; Ellen 1996). Those farmers and ranchers who participated in my thesis research, employ feelings and beliefs about local weather patterns as well as meteorological reports from Alberta Agriculture, embodied hands-on experience gained over generations, along with technology and world market economics, and local-level roadside discussions with their neighbours to mediate their adaptability to agricultural drought. Instead of narrowly focusing the lens of climate change research on technology, economics, or politics to view human adaptability to environmental stress, a consideration of human relationships and cultural practices that give climate and weather its meaning would widen this lens on people's wholistic and dynamic interaction to their biophysical environment.

In this thesis, I proposed to identify farmers' and ranchers' cultural meaning of climate and weather that potentially mediate their adaptability to agricultural drought in an east-central Alberta prairie agro-ecosystem. I considered household-level beliefs and values of farmers and ranchers (research participants), which underlie their experience with agricultural drought and their perception of interannual climate variability. Employing an ethnographic framework in this thesis research, I contended that meanings embed climate and weather, and that these meanings include utilitarian and intangible values that emphasize people's cultural meaning of climate and weather. Using an anthropological eye and ear I argued that weather and climate is not just an operational reference to meteorological variables, it is also a real context for human relationships and cultural practices that give climate and weather its meaning through time and space.

While adopting an anthropological approach in my thesis research, I used insights from the narratives to elucidate research participants' cultural meaning of climate and weather. Although each research participant talked about the physical effects of aridity on their land, crops, and animals, which were similar between each participant, each narrative was rooted in each research participants' personal experiences and individual observations. From the research participants' definition of agricultural drought, I explored the relationship between two examples of local knowledge of weather and climate: research participants' experience with agricultural drought, and their observation of local weather. I took experience of agricultural drought to be locally specific and experienced-based that involves a mutual and practical interaction between people and their physical environment. I used two themes to illustrate this concept. The first theme is precipitation, specifically rainfall and snowfall. Precipitation plays a significant role in a non-irrigated, semi-arid agro-ecosystem. Reiterating one research participant, *"The one ingredient is moisture. You need moisture. Rain and snow absolutely affects a farmers' world."* (RP-10, 10 August 2004). The second theme is local weather variability. Research participants revealed to me that their collective cultural knowledge of folk meteorology resides in weather phenomenon and trends being *"reliable"*, *"readable"*, and *"true.* Although uncertain and variable weather conditions have always been part of the farming and ranching scenario in the Bodo community, the narratives illustrated that research participants perceive extreme local weather variability as the reason for unreliable, unreadable, and untrue weather phenomenon.

In addition, I borrowed concepts and theory from historical ecology to consider climate and weather as a culturally constructed place. I discussed that climate is not simply an inert container for biophysical features and measurable attributes. I argued that climate is an abstraction that is constructed – and continuously reconstructed – through cultural processes that assign meaning. I further discussed my insights gained through the analysis of research participant's narratives, and interpreted these insights through historical ecology. In my analysis, I identified spatial and temporal themes in research participants' cultural meaning of climate and weather. The spatial theme illustrated research participants' shared local experience and knowledge of agricultural drought, whereas the temporal theme examined the varied experience and perception of agricultural drought between generations.

In this thesis, I demonstrated that the human-environmental interaction is distinctive in this particular east-central Alberta prairie community of Bodo. Research participants believe that they have an understanding of their local weather and climate that comes from their long-term, daily and seasonal connection to their physical environment. Farmers and ranchers from the research area live and farm in a non-irrigated, semi-arid agro-ecosystem where short-term drought is common and long-term drought is increasingly more frequent. Risk, acceptance, and uncertainty not only define the local weather and climate in Bodo, but they also underline research participants shared locally-specific and experience-based knowledge of agricultural drought, and the varied experience and perception of agricultural drought between generations. This perspective allows research participants to appreciate that they, as a particular social group, Canadian prairie farmers and ranchers, are part of a dynamic ecosystem of extreme weather variability where their knowledge and experience is always partial and conditional. Climate and weather are one of the most important topics they discuss in terms of climate variability and weather patterns, and the effects of environmental stress (agricultural drought) on farm practices. Even if my research participants were not talking about climate, weather, and drought, I was quite certain that they were aware of it, monitoring it with multiple senses, and processing the possible changes they will make in their farming strategies.

Future Research

> A major portion of any human response to climate or other environmental change is through behaviours that are intangible: changes in social networks, in relations of reciprocity, or in the cosmology that defines the place of humanity in nature. (McIntosh et al 2000: 6)

> Ecosystems care not about climate, biodiversity, nutrient leakages, or whether they lose species. Whatever happens, they adjust automatically. It is only people, who care about these things, and that concern is what justifies and sustains the research of both biophysical and social scientists. (McIntosh et al 2000:7)

My introduction to the anthropology of weather and climate began with a seminar textbook, *The Way the Wind Blows: Climate, History, and Human Action* (2000). Taken from this textbook the above quotes represent my initial thoughts of a Master's topic: human perception of climate and weather and response to environmental stress, and anthropology's role in climate change research. The seminar professor (who became my Master's supervisor) convincingly made a case that I should consider an ethnographic study that considers prairie farmers' perception of climate variability and experience with agricultural drought. As my Master's program progressed from readings, to fieldwork, to data analysis and thesis writing the value and relevance of an anthropological-directed ethnographic study in climate research became apparent. A fundamental aim of an ethnographic study is to look past regional and national trends and to hear individual and community stories. However, even in the smallest of communities, such as Bodo, there is the telling of many tales. Thus, even at the local level, a researcher must look for patterns and generalizations. Nevertheless, it also is possible to highlight some of the idiosyncrasies these tales reveal. The result is an illustration of both the common elements and the diversity of perspectives found in any social and cultural setting.

Farmers and ranchers in an agricultural community frequently have to deal with extremes or anomalies such as floods, droughts, and storms, both individual weather events and patterns of occurrence, which may be significant over periods of days, seasons, years, or decades. Research analyzing the processes by which members of such a community cope with or manage such environmental stress is about adaptation, and it is an essential element in agricultural adaptability initiatives. Although such initiatives employ farm-level surveys and questionnaires, conduct town-hall type meetings, and examine local-level climate and weather events, their focus tends towards technological or economic decision-making strategies. Acknowledging social and cultural processes as a factor in agricultural producers adaptive strategies, they are rarely if at all pursued as a fundamental aspect.

An example of the contribution that anthropology can make to climate research and agriculture is Vedwan and Rhoades' (2001) research among apple growers of the mountain region of Himachal Pradesh in northern India. Vedwan and Rhoades research focuses on perceptions of climate change, emphasizing how this is key to illustrating patterns of human adaptation. Particularly, they show that experience and observation shape perceptions of degrees, direction, impact of climate change. Orchard farmers, similar to Canadian prairie farmers and ranchers, use product performance to notice climate events, such as shifts in snowfall, rainfall, and temperature, which they judge as associated with change in production outcomes. Farmers' knowledge of crop-climate interactions is the cognitive window through which they identify and classify climate variability.

An example of social and biophysical scientists collaborating is the University of Arizona's Climate Assessment Project of the Southwest (CLIMAS) study of climate-related vulnerability of human communities within Arizona's Middle San Pedro River Valley (MSPRV). The project involved interdisciplinary (applied anthropology, geography, geology, and palaeo-climatology) collaboration on a common, complex research problem, while directing the research toward a social goal consistent with the priorities of local communities. In order to achieve this integrated end, the research team employed qualitative and participatory ethnographic methods to provide the social science data that complemented data of the natural processes in the MSPRV (Finan et al 2000). The final report is an integrated assessment that considered the natural processes (rainfall, subsurface flow and availability) with social-economic processes (population growth, resource use and management, shifts in livelihood). Analysis in their report include: ethnographic field data (primary source), surface and groundwater hydrology, land cover/land use changes, impacts on water and electricity, transportation, and geographic computer modeling and cartographic analysis.

Climate and weather are but two of many factors of concern to decision makers, policy makers, business owners, farmers and ranchers, and residents of any area. Generally, climate and weather become a priority only when inhabitants and leaders confront the immediacy of environmental stress. Nonetheless, climate and weather influence development in an area, and cultural meaning of climate and weather shape the constraints and opportunities available to inhabitants. As such, recommendation for future research is to gather narratives (oral and written histories) from a range of community residents and leaders in order to generate a wider illustration of the cultural meaning of climate and weather from the members of the Bodo community and the surrounding region. Future research could focus on how weather is communicated through modern scientific meteorology and folk meteorology, how people view climate from multiple perspectives (moral, political, economic significance), and how historical processes factor between local climate and weather and human decisions about the land

and its resources. Such ethnographic studies would examine linkages between the research participants of this thesis to people, places and institutions beyond the Bodo community. The strength of ethnographic studies would allow the researcher to document factors and how they are inter-related, investigating critical connections that may go unnoticed in a statistical analysis of relationships among variables. Moreover, ethnographic research, with its emphasis on long-term fieldwork and its privileging of local knowledge and local perspectives, provides a high level of cultural contextualization and data reliability that is critical for developing human adaptation policies.

PLATES

Plate 1: Cattle in pasture (September 2004)

Plate 2: Slough (July 2005)

Plate 3: Cutting crop field for silage (September 2004)

Plate 4: Cutting alfalfa field (August 2004)

Plate 5: Stormy skies and cultivated crop field (September 2004)

Plate 6: Stormy skies and dried-out slough (September 2004)

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APPENDIX A

AGRO-ECOLOGICAL LAND CLASSIFICATION

	Econzone: PRAIRIE
Soils	▪ Chernozems, major (Brown, Dark Brown, Black) ▪ Solonetz, minor (Brown)
Geomorphology	▪ nearly level to rolling plains with mainly hummocky glacial moraine. ▪ level to gently undulating lacustrine deposits.

	Ecoregion: MOIST MIXED GRASSLAND
Soils	▪ Chernozems (Dark Brown) ▪ Solonetzic
Geomorphology	▪ hummocky to kettled glacial till ▪ level to very gently undulating, sandy to clayey lacustrine deposits ▪ intermittent sloughs and ponds
Native Vegetation	▪ dominate: *Festuca scabrella* (rough fescue), *Koeleria cristata* (junegrass), *Stipa curtiseta* (western porcupine grass), *Elymus lanceolatus (*northern wheatgrass), and *Helictotrichon hookeri* (Hooker's oatgrass). ▪ common forbs: *Anemone patens* (prairie corcus), *Artemisia ludoviciana* (prairie sagewort), *Cerastium arvense* (mouse-ear chickweed), *Linum lewisii* (wild blue flax), *Erigeron glabellus* (fleabane), *Galium boreale* (northern bedstraw), *Campanula rotundifolia* (harebell), and *Geum triflorum* (old man's whiskers). ▪ deciduous shrubs: *Elaeagnus commutata* (silverberry or wolf willow) or thickets of *Rosa acicularis* (prickly rose), *Symphoricarpos occidentalis* (western snowberry or wolfberry), *Ceanothus cuneatus* (buckbrush), *Prunus virginiana* (chokecherry), and *Amelanchier alnifolia* (Saskatoon).

	Ecoregion: ASPEN PARKLAND
Soils	▪ Chernozems (Black)
Geomorphology	▪ undulating to kettled, calcarious, glacial till ▪ significant areas of level lacustrine and hummocky to ridged fulvioglacial deposits
Native Vegetation	▪ main tree species: *Populus tremuloides* (trembling aspen) groves in the south to expansive aspen forest in the north – aspen and *Populus balsamifer* (balsam poplar) ▪ common forbs: *Festuca scabrella* (rough fescue) dominates most sites with *Stipa curtiseta* (western porcupine grass); *Koeleria micrantha* (junegrass) and *Agropyron smithii* (western wheatgrass). ▪ shrubs: *Symphoricarpos occidentalis* (western snowberry), *Rosa spp.*, *Prunus virginiana* (chokecherry), *Prunus pensylvanica* (pincherry), *Amelanchier alnifolia* (saskatoon berry), and *Elaeagnus commutata* (silverberry)

	Ecoregion: NEUTRAL HILLS
Soils	▪ Chernozems (Dark Brown) ▪ soil texture: medium to moderately fine loams and clay loams.
Geomorphology	▪ hummocky uplands with slopes of 5%-15%, and significant portion (20%-40%) in steep lands with slopes of >15% and undulating and level plains with slopes of <5%.

	Ecoregion: PROVOST
Soils	▪ Chernozems (Dark Brown) ▪ soil texture: medium to moderately fine silt loams with significant amounts (20%-40%) of moderately coarse sandy loams.
Geomorphology	▪ mainly undulating and level plains with slopes of <5% with significant portions (20%-40%) of rolling uplands with slopes of 5% to 15%.

	Ecoregion: EDGERTON
Soils	▪ Chernozems (Dark Brown) ▪ soil texture: coarse sands and loamy sands with significant amounts of moderately coarse sandy loams.
Geomorphology	▪ dominant landform is hummocky uplands with slopes of 5%-15%, and 20%-40% of the area is undulating and level plains with slopes of <5%.

	Land System: ALTARIO UPLAND
Soils	▪ Chernozems (Dark Brown) developed on parent material of medium textured till dominant; significant eroded soils present.
Geomorphology	▪ low to medium relief hummocky geomorphology of stagnation moraine with some high relief hummocky moraine.

	Land System: FALCON PLAIN
Soils	▪ Chernozems (Dark Brown) developed on medium textured till and medium textured parent material over medium textured till. ▪ Solonetz is a minor soil.
Geomorphology	▪ low relief hummocky stagnation moraine and some high relief undulating terrain; minor representation of moderate relief of hummocky stagnation moraine.

	Land System: HANSMAN PLAIN
Soils	▪ Chernozems (Dark Brown) developed on medium textured water-laid sediments and medium textured parent material over medium textured till. ▪ minor soils include Solonetz and coarse textured soils.
Geomorphology	▪ undulating with high relief and with some low relief hummocky stagnation moraine.

	Land System: SUNKEN LAKE PLAIN
Soils	▪ Chernozems (Dark Brown) developed on coarse textured sediments. ▪ minor soils include Gleysols and significant eroded soils.
Geomorphology	▪ low relief of longitudinal sand dunes with some landscape undulating (high relief).

APPENDIX B

BEDROCK GEOLOGY

Formation	Nonmenclatural Symbol	Sediment
Bearpaw	Kbp	- dark grey, blocky shale and siltstone (major) - greenish glauconitic and grey clayey sandstone with thin concretionary ironstone (minor)
Oldman	~	- sandstone, siltstone, shale, coal (continental)
Foremost	~	- sandstone and shale (marine) - shale and ironstone (continental)
Belly River Group	KBR	- grey to greenish grey feldspathic sandstone - grey clayey siltstone - grey and green mudstone - concretionary ironstone beds of marine-deltaic-fluvial origins
Lea Park	Klp	- dark grey shale (major) - Bentonitic sandstone (minor)

APPENDIX C

ETHICS STATEMENT and RESEARCH PROPOSAL

General Faculty Council Policy Manual, Section 66: Guiding Ethical Principle
Cultural Meaning of Climate and Weather: Agricultural Drought in East-Central Alberta

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Purpose of Research:

I will be undertaking thesis research that will require formal interviews with several individuals from a rural, east-central Alberta community. This thesis research is conducted through the University of Alberta's, Department of Anthropology. My co-supervisors are Dr. Charles Schweger (Professor, Department of Anthropology) and Dr. Terry Gibson (Adjunct Professor, Department of Anthropology).

My thesis research addresses the means by which climate change influences culture change. My investigation focuses on the ways in which individuals construct, maintain, and transmit both knowledge of past environmental conditions and possible cultural responses to a changing climate. In particular, I am interested in documenting individual attitudes, experiences, and observations about 20th century dry climate periods in a rural, east-central Alberta community.

Principle 1: Respect for Human Dignity

As the sole researcher/interviewer, I will inform participating informants about the purpose and nature of my thesis research, including the process of the formal interview. Before interviews begin informants will have the opportunity to express their concerns and to ask questions, which will be addressed and answered to their satisfaction. Informants will be told that they may contact the Chair of the Research Ethics Committee at the University of Alberta for information regarding their rights as a voluntary participant in an academic research study. In addition, informants will be told that they may contact my co-supervisors if they have any concerns about my intentions and/or conduct, the thesis research, the formal interview process and/or the final venue of the data (thesis). All relevant contact information will be provided to the informant before the start of the interview.

Once an informant provides their consent, they will engage in the formal interview process on a voluntary basis. Informants will be told explicitly that they have the right to refuse to answer any questions, withdraw their answer, and/or terminate the interview at any time. They also have the right to request breaks, and to stop and resume the interview whenever they wish. In addition, every attempt will be made to schedule interviews (date, time and location) at the informant's convenience and preference.

Principle 2: Respect for Free and Informed Consent

The consent form clearly outlines the thesis research's purpose, nature, and benefits to the researcher and the participating informant. Included is a statement that no short- or long-term harmful effects are anticipated from an informant's participation in the formal interview. The consent form also outlines how the interview will be documented (tape recordings/written notes), who will have access to the data and the thesis, and how an informant's contributions will be used in the thesis research. The rights of a participating informant, as outlined in the Standards for the Protection of Human Research Participants, will be detailed and listed on the consent form. Informants who wish any additional conditions for their participation will have these conditions included in the consent form. Furthermore, the consent form states that to participate in the research informed consent must be voluntary, and that they are free to not participate in any part of the research or to withdraw from the research at any time.

Informants will be told that the University of Alberta maintains strict standards for the protection of a "human research participant" as outlined in the Standards for the Protection of Human Research Participants. A copy of the Standards will be provided to an informant upon request. In addition, informants will be given a copy of the research questionnaire so they are aware of the types of questions that will be asked during the interview. Finally, a copy of the consent form will be given to an informant for them to read and sign before the interview begins.

A second form, "Termination of the Formal Interview Process", will be provided to those informants who decide to terminate the interview process. This form will state that the informant's termination of the interview is voluntary. It will outline that the informant has the right either to request that all of their information be destroyed or to dictate what information may or may not be included in the final analysis of the thesis research.

Principle 3: Respect for Vulnerable Persons

Children, institutionalized persons and others who are vulnerable, lacking competence or decision-making capacity, as defined by the University of Alberta's Standards for the Protection of Human Research Participants will not be approached or considered as informants for this thesis research.

Principle 4: Respect for Privacy and Confidentiality

This thesis research study will be conducted in and around a rural, east-central Alberta farming community. All informants who participate in the formal interview process either live and/or work within this community. Two factors are relevant when considering the privacy and confidentiality principle. The first factor is that close and intimate knowledge of family members, individuals and neighbours does exist. The second factor is that information obtained through the interview will be used and published in a public, academic document (Master of Arts thesis). Therefore, in order to "protect the access, control and dissemination of personal information" and to guarantee that "privacy, confidentiality and anonymity [is] respected", as it is outlined by the University of Alberta's Standard for the Protection of Human Research Participants, participating informant have the right to remain anonymous. If an informant chooses anonymity then all documents (notes, tape recordings, interview transcripts, thesis) pertaining to the interview, including all discussions between myself, my thesis co-supervisors, and other individuals and/or groups will identify the informant by their alias.

Principle 5: Respect for Justice and Inclusiveness

I do not anticipate that my thesis research will unfairly burden one segment of the population nor will it neglect or discriminate against those who may benefit from the analysis of this thesis research. This thesis research could directly affect the whole community, as it is an investigation in the ways individual's construct, maintain and transmit both knowledge of past environmental conditions and possible responses and strategies to a changing climate. The thesis will be made available to participating informants and community members, thus ensuring that fair and equal access to the final written document (thesis) is upheld.

Principle 6: Balancing Harms and Benefits

The benefit of this formal interview process is to document how an individual's attitudes, experiences and observations about historic dry climate periods have shaped not only their worldviews and values about their environment but also their response and strategies to climate change. Participating informants will be reminded that because the rural community under this thesis research is relatively small, their identity may be obvious to others within the community and/or to those who may read the thesis. However, I will be the only person with access to an informant's identity and I will make every effort to assure them that all personal records relating to their interview will be kept confidential and safe. Meanwhile, informants will have the opportunity to correct, change, and edit their personal information, thus providing them with a level of control.

Principle 7: Minimizing Harm

I do not foresee any harm to an informant because of their participation in this thesis research and the formal interview process. Participating informants will be given the opportunity to read the consent form before commencing with the interview. They will be provided the necessary time to make an informed decision about whether or not to participate as a volunteer informant. Once the informant signs the consent form they acknowledge that they fully understand and agree with the following: the voluntary nature of the participation; the nature and purpose of the thesis research; the opportunity to assess the thesis research risks and benefits; the right to terminate the interview process, to refuse to answer questions, and to withdraw from the research without any repercussions; the right to express concerns and ask questions at any time during the interview; the right to correct, change and edit their information; and, the right to the use or destruction of any information obtained during the interview. Once the thesis is published, the researcher acknowledges that unforeseen harm could result by the information being misused by individuals, private groups, or governmental/non-governmental agencies for their own benefit and possible profit. Such potential harm will be taken into consideration when preparing the thesis.

Principle 8: Maximizing Benefit

This thesis research would benefit all people, as it will draw upon a reservoir of human experience with historic climate change, which has not been readily explored in climate change research projects. At the individual level, informants can benefit from their participation in the formal interview by reflecting on their own ideas about their environment, and by exploring their own responses to climate change. At the academic level, this thesis research will add to the existing knowledge on drought on the Canadian Prairies. It will demonstrate the importance of the history of human-environmental interactions, which is a vast source of information about how people have observed and coped with climate change in the past. What is learned may have relevance in how societies cope with future climate change. At the personal level, I will benefit directly from this thesis research and formal interview process for two reasons. The first is that it allows me, as a graduate student, to gain experience in ethnographic fieldwork. The second is that it provides me with data to complete the written requirement of a Master of Arts degree as outlined by the University of Alberta's Faculty of Graduate Studies and Research and the Department of Anthropology.

I have read, understood and will adhere to, the guidelines of the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans, and the University of Alberta Standards for the Protection of Human Research Participants (General Faculty Council Policy Manual, Section 66) and agree to abide by these standards in conducting research.

April 2004

Michelle Ann Borowitz

APPENDIX F

Thesis Research Description & Consent Form for Formal In-Person Interview
Cultural Meaning of Climate and Weather: Agricultural Drought East-Central Alberta

My thesis research addresses the means by which climate change influences culture change. My investigation focuses on the ways in which individuals construct, maintain, and transmit both knowledge of past environmental conditions and possible cultural responses to a changing climate. In particular, I am interested in documenting how individual attitudes, experiences, and observations about 20th century dry climate periods in the Bodo/Eyehill Creek locality have shaped not only their worldviews and values about their environment but also their responses and strategies to climate change.

I am the sole researcher/interviewer who will conduct this thesis research and formal in-person interviews. This project is being conducted through the University of Alberta's, Department of Anthropology. My thesis co-supervisors are Dr. Charles Schweger, (Professor, Department of Anthropology) and Dr. Terry Gibson (Adjunct Professor, Department of Anthropology).

I am collecting individual observations, experiences and opinions about dry climate periods in the Eyehill Creek/Bodo locality. I am particularly interested in seeing any photographs, paintings, and drawings depicting the landscape of this locality. In addition, I am interested in reading any farm journals, newspaper articles and reports that you may like to share with me.

For this formal interview, questions will be asked about what your personal experiences have been concerning dry climate periods, therefore right or wrong answers do not exist. You have the right to ask questions about my thesis research and the interview process at any time.

This is a formal interview, which could involve more than one meeting and could in total last several hours; however, the frequency of meetings and the length of time for each meeting is solely your decision. Interviews will be tape recorded and later transcribed. I will contact you if the transcriptions require clarification. I will be the only individual with full access to your personal information; however, Dr. Schweger and Dr. Gibson will have limited access.

Your identity will remain anonymous throughout the course of my thesis research and your alias will be used in all documentation. All information obtained from this thesis research and the formal interview will be kept confidential and will only be used to investigate how local people construct and transmit knowledge about their environment and how they respond to climate change. Final analysis will be published as a partial fulfillment of the requirements for a Master of Arts degree and it will be available to the public.

In general, this thesis research would benefit all people, as it will draw upon a reservoir of human experience with historic climate change, which has not been readily explored in climate change research projects. At the individual level, you may benefit by reflecting on your own ideas about your environment, and by exploring your own responses to climate change.

The Bodo/Eyehill Creek community is relatively small, so your identity may be obvious to others within the community and/or to those who may read the thesis. However, I will be the only person with full access to your identity and I will make every effort to ensure that all personal records relating to your interview will be kept confidential and safe. Meanwhile, you will have the opportunity to correct, change, and edit your personal information during the interview process.

At any time, you have the right to:

(1) ask any questions regarding my thesis research and the formal interview process;
(2) request anonymity;
(3) refuse to answer any question;
(4) request a break or to reschedule the interview;
(5) request the interview to be arranged and scheduled at your convenience;
(6) review my interview notes and final analysis of the information;
(7) withhold any personal information provided during the interview;
(8) terminate the interview;
in which case you have the right to:
    a. request that certain portions of the information you provided during the interview be used in the analysis process;
    b. request that all, or portions, of the information be either destroyed or given to you.
(9) exercise any of the above listed rights without repercussions;
(10) Additional conditions for my participation in this formal interview process are noted here:

____
____
____

I acknowledge the purpose and nature of the thesis research described above, of which I have a copy, has been explained to me, and that any questions that I have been answered to my satisfaction. I accept that my participation in this thesis research and formal interview process is voluntary. In addition, I know that I may contact Dr. Schweger, Dr. Gibson or the Chair of the Research Ethics Committee if I have further questions either now or in the future.

I have been informed of the purpose of my participation in this formal interview. I understand the possible benefits of joining the interview process as well as any possible risks. I have been provided with sufficient time to reflect on my decision to participate. I am fully aware that others will be reading the final analysis of this thesis research and that it will eventually be published and made available to the Bodo/Eyehill Creek community.

I have been made aware of my rights as a participating volunteer informant. I have been assured that personal information relating to this thesis research will be kept confidential and that upon request my identity will remain anonymous throughout the course of this thesis research and in any publication.

By signing, you fully acknowledge and accept the information, rights and conditions, as outlined above, and you give your permission to participate in this thesis research and formal interview as a volunteer informant.

Signature of Volunteer Informant	Printed Name	Date
Signature of Witness	Printed Name	Date

I have explained this thesis research study and formal interview process to the volunteer informant who signed above, and I am satisfied that both are understood by this individual.

Signature of Researcher/Interviewer	Printed Name	Date

APPENDIX G

Proposed Questions for Research Thesis
Cultural Meaning of Climate and Weather:
Agricultural Drought in East-Central Alberta

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1) How many years have you lived in the Eyehill Creek/Bodo area?
2) Do you recall any time when you were living in this area that you considered the climate to be dry? When was that period of time?
3) Describe for me what I would see if I were to look at this land during a year when the climate is dry? What would I see during a year when the climate is wet?
4) What have you been told of the dry climate period in the 1930s? Where did the information come from?
5) What did people do during the dry climate period in the 1930s? How did it affect you? How does it affect you?
6) What do you do during a year when the climate is dry? During a year when the climate is wet?
7) Do you consider dry climate periods in the past as more or less dry than current dry climate periods?
8) Describe for me the kinds of weather changes that you have noticed when you have been in the Bodo/Eyehill Creek locality?
9) Where do you get information about dry climate periods? What type of information is it that you use? Do you think this information useful?
10) Based on your experience and observations of changing climates and dry climate periods what are the advantages/disadvantages of the Bodo/Eyehill Creek locality?

NOTE: These are open-ended questions; therefore, further questions will follow the actual interview conversation as opposed to the questionnaire dictating a single course of the conversation.

APPENDIX H

Contact Information

Dr. Denise Spitzer,
Assistant Professor
Department of Anthropology Ethics Advisory Group
Statutory Member of Faculty of Arts, Science & Law Research Ethics Board

Phone Number: 780-492-3879

Dr. Charles Schweger
Professor, Department of Anthropology
University of Alberta

Phone Number: 780-492-3879

- Dr. Schweger is on a one-year sabbatical (May 2004-May 2005). Messages can be left at the above phone number.

Dr. Terry Gibson
Adjunct Professor, Department of Anthropology
University of Alberta

Phone Number: 780-458-5698

Dr. Ray Leblanc
Professor & Acting Chair, Department of Anthropology
University of Alberta

Phone Number: 780-492-3879

Michelle Borowitz
M.A. Candidate
Department of Anthropology, University of Alberta

Cell Number: 780-721-8984
Email Address: borowitz@ualberta.ca

APPENDIX I

SOCIO-ECONOMIC HISTORY of RESEARCH PARTICIPANTS

Research Participant-1

- A first generation Canadian, the research participant was born in 1924, and has lived and farmed in the research area for his entire life. In 1907, his father, a mid-west farmer, left Wisconsin, United States and homesteaded in the research area. The research participant has raised a small herd of cattle (approximately 10 head) in the past, but currently he is only cultivating cereal crop and alfalfa. He manages five, quarter sections of land (800 acres or 325 hectares), which is partially under alfalfa, or seeded with wheat, barley, or oats. He considers himself a mid-size farmer.

Research Participant-2

- The research participant born in 1923 and is a first generation Canadian. Parents were mid-west farmers from Minnesota, United States, who homesteaded in the research area in 1907. The participant researcher has always lived and farmed in the research area. As well her involvement in the daily and seasonal operations on the farm, she managed a household and raised four children. She shares ownership of the farm and land with her husband.

Research Participant-3

- Born in 1962, the research participant is a first generation Canadian, and has lived and farmed in the research area for his entire life. The research participant worked full-time in the oil and natural gas industry for 25 years and part-time on the family-owned farm until 1996 when he assumed full-time operation and management. Currently, the research participant works full-time operating a cow-calf operation (approximately 100 head of cattle), cultivating cash crops (wheat and canola) and silaging livestock feed. He works part-time in the oil and natural gas industry. Adult children help with daily farm chores and seasonal operations. Sharing the operation and management with his wife the research participant has approximately ten, quarter sections of cultivated land, three quarter sections of pastureland, and two quarter sections of alternating pasture/alfalfa/cultivated land (approximately 2400 acres or 970 hectares of land). He classifies the farm as mid-size.

Research Participant-4

- The research participant was born in 1964 and she is a second generation Canadian. She has extensive experience working with horses and cattle, but until moving to the research area in 1996, she did not work on a grain farm. The research participant learned how to operate a hay-baler, silage cutter, and combine. Currently, she works full-time on the family owned farm/ranch. Along with the daily and seasonal farm duties, the research participant shares the management of the household and farm business with her husband.

Research Participant-5

- A first generation Canadian, the research participant was born in 1936, and has lived and farmed a majority of her life in the research area. She lived outside the research area twice in her lifetime: once, during the 1930s her family moved north of the research area for a couple of years before returning; and, the second time for one year with her husband in 1962. In addition to managing a household and raising nine children, she was actively involved in the operation and management of the family farm. The research participant farmed 1360 acres during the 34 years she and her late husband managed and operated the farm. Currently, she holds a permit book for approximately 160 acres of cultivated land and she rents the remaining original acres to others. In consultation with her son, she makes decisions regarding the use of the land.

Research Participant-6

- A first generation Canadian, the research participant has lived and farmed in the research area for his entire life. The research participant owns and operates his cow-calf operation and works full-time on the farm. He manages ten sections of cultivated land, improved pastureland, or native prairie land. He cultivates alfalfa hay, silage, and green feed for livestock. He classifies his operation as mid-size.

Research Participant-7

- The research participant is a first generation Canadian. The research participant is original from a farming community northwest of the research area. She moved into the area after her marriage. In addition to her involvement in the daily and seasonal operations on the farm, she managed a household and raised three children. The research participant also worked off the farm until 1969. Currently, the research participant manages the farm household and the farm accounts. She shares ownership of the ranch and land with her husband.

Research Participant-8

- A first generation Canadian, the research participant was born in 1930, and has lived and farmed in the research area his entire life. In 1908, his father immigrated to Canada from Norway. Currently, the research participant is a grain farmer (wheat, oats, barley). Along with his wife, the research participant owns and manages 11-quarter sections of land: one-quarter section is native prairie, while the remainder is cultivated land. He classifies his farm as mid-size. The research participant generally carries out the harvest, but he has hired custom combiners in previous years.

Research Participant-9

- Born in 1932, the research participant is a first generation Canadian. The research participant was originally from a farming community (Amisk, Alberta) northwest of the research area and she did not move into this area until 1957. The research participant has lived on a farm her entire life. In addition to managing a household and raised three children, the research participant was actively involved in the daily and seasonal operations on the farm. Throughout her married life, the research participant has shared ownership and management of the farm with her husband.

- **Research Participant-10**
  The research participant is a second generation Canadian. Born in 1973, he has lived in the research area his entire life. Even though the research participant has always worked on the family farm, he has worked off-farm jobs. Currently, along with the on-farm work the research participant works full-time in the oil and natural gas industry. The majority of this land is improved pasture (grazing land). The remainder of the land is cultivated for alfalfa hay, silage and green feed. The research participant manages a cow-calf operation and classifies his ranch as mid-size.

- **Research Participant-11**
  The research participant was born in 1935 and he is a first generation Canadian. He has lived and farmed in the research area his entire life. His father immigrated to Canada from the Odessa area of the Crimea, Russia in 1914, and homesteaded in the research area in 1930. The research participant owned and operated a mixed farm operation of cattle and cereal crop for 40 years. Currently, semi-retired from farming the research participant does seasonal work (silage and harvest) for kin members. Along with his wife, the research participant operates and manages seven-quarter sections of land that he rents out to other farmers. The majority of this land is cultivated under hay and cereal crop and the remainder is improved pastureland.

- **Research Participant-12**
  Born in 1942 the research participant is a first generation Canadian. The research participant has lived and farmed in the research area her entire life. Her parents immigrated to Canada from Russia in 1912 and homesteaded in the research area in 1920. As well as her involvement in the daily and seasonal operations on the farm, she managed a household and raised three children. The research participant also worked off the farm until 2003. Currently, retired from farming the research participant and her husband remain active in the community. She shares ownership of the farm and land with her husband.

- **Research Participant-13**
  The research participant is a second generation Canadian. Born in 1971, he has lived and farmed in the research area his entire life. The research participant works full-time operating his cow-calf operation (approximately 120 head of cattle), and cultivating cash crops (wheat and barley) and alfalfa hay (livestock feed). Since 1992, he has been working part-time in the oil and natural gas industry. The research participant shares the operation and management of the farm with his wife. They have approximately 15, quarter sections of cultivated land and five quarter sections of pastureland. The research participant classifies the farm as mid-size.

Research Participant-14

- The research participant was born in 1974 and is a second generation Canadian. In 1995, the research participant moved into the research area, before then she was living and working in a farming community northeast of the area. She has lived and worked on a farm her entire life. She has extensive experience working with livestock and operating farm equipment. As well as managing a household and raising three children, the research participant works full-time on the family owned farm/ranch. The research participant shares the management and operation of the farm business with her husband.

Research Participant-15

- The research participant is a first generation Canadian, and has lived and farmed in the research area his entire life. The research participant operates and manages a full-time cow-calf operation and he is a crop producer. In addition, he works part-time in the oil and natural gas industry. The research participant manages approximately 1500 acres or 610 hectares of cultivated land and pastureland. He classifies his farm/ranch operation as mid-size.

Research Participant-16

- The research participant is a first generation Canadian. Born and raised in a farming community northeast of the research area, the research participant did not move into this area until after her marriage. The research participant manages the farm household and raises three children with her husband.

Research Participant-17

- The research participant is a first generation Canadian. She lived and farmed in the research area with her husband.

Research Participant-18

- The research participant was born in Provost, Alberta and he is a first generation Canadian. He has lived and farmed in the research area his entire life. The research participant works full-time operating a cow-calf operation (approximately 120 head of cattle) and cultivating cash crops (wheat, barley and oats). He works part-time in the oil and natural gas industry. Adult children help with daily farm chores and seasonal operations (haying and harvesting). Sharing operation and management with his wife the research participant has approximately eight-quarter sections of cultivated land, eight-quarter sections of pastureland (approximately 2560 acres or 1010 hectares of land). He classifies the farm as mid-size.

Research Participant-19

- The research participant is a third generation Canadian. Born and raised in a farming community (Macklin, Saskatchewan) northeast of the research area, she did not move into this area until 1979. She has lived and worked on a farm for most of her life. She has extensive experience working with livestock. As well as working full-time on the farm the research participant is working part-time in an off-farm job. The research participant shares the management and operation of the farm business with her husband.